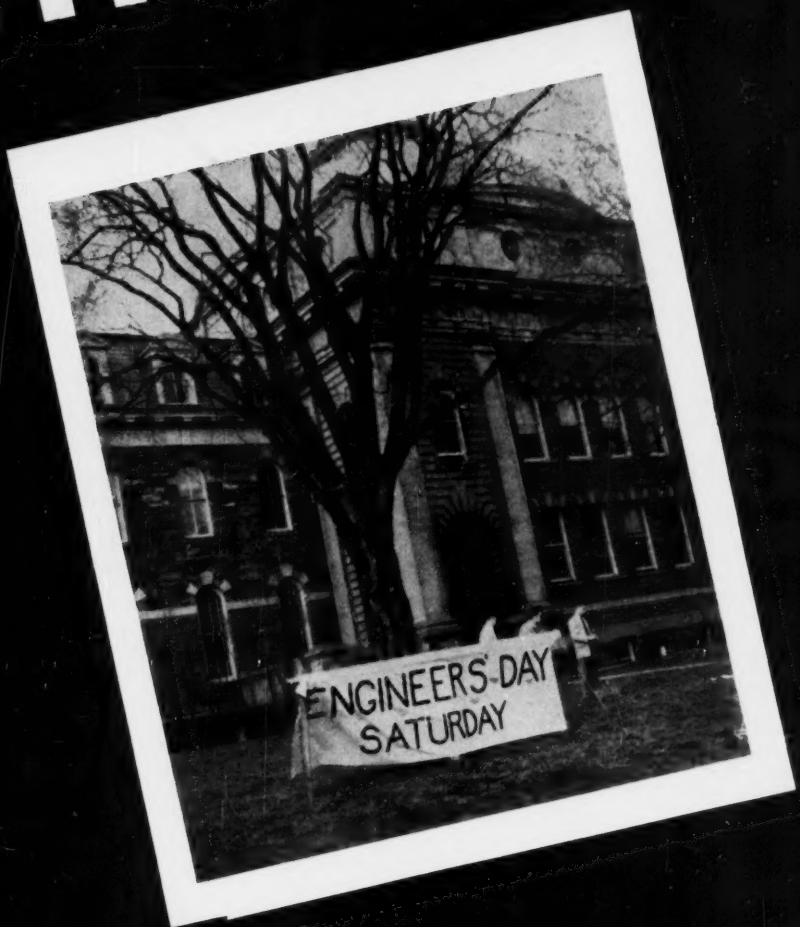
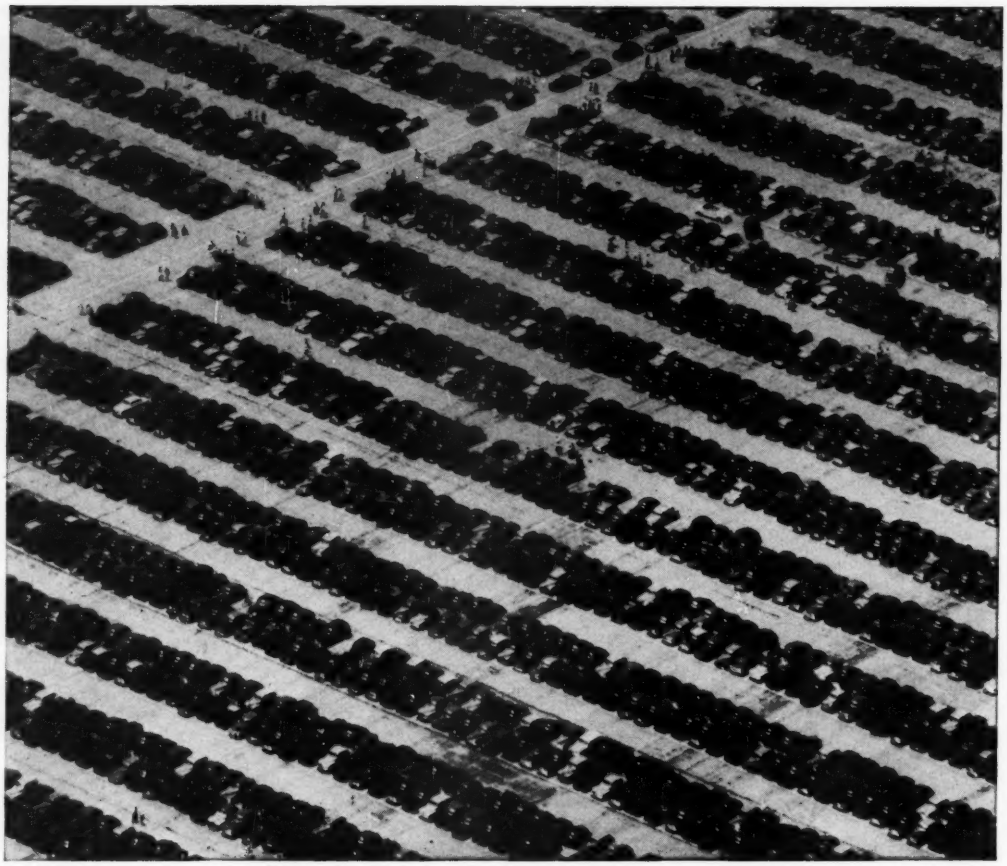
THE CORNELL ENGINEER



COLLEGE OF ENGINEERING · CORNELL UNIVERSITY

6,250,000 in 1949—*another new record*



THE automobile industry smashed records again in 1949 as it produced 6,250,000 new passenger cars and trucks —more than in any other year in history. This terrific output of the finest cars ever made climaxed a phenomenal rise in production that began at the war's end.

These new cars by the millions are a tribute to the American way of life. Their production is the result of the demands of people working under the American system of free enterprise, which has produced the highest living standard the world has ever known.

Millions of tons of steel of almost every type and form helped America's auto makers boost their production so amazingly high . . . helped the quality of today's automobiles keep pace with the quantity. In fact, many new steels have been developed just to meet the exacting requirements of present-day production.

In spite of record-breaking production, the automobile industry's job is far from finished—the average age of the cars on America's highways today is 8.4 years.

Continuing demands for vast quantities of steel from the automobile industry and from countless other sources mean a big job for the steel industry in coming years . . . mean a promising future for men who make steel their career. To assure itself management men of the highest caliber, United States Steel maintains a continuous training program that prepares young men with suitable backgrounds for places in this great industry.

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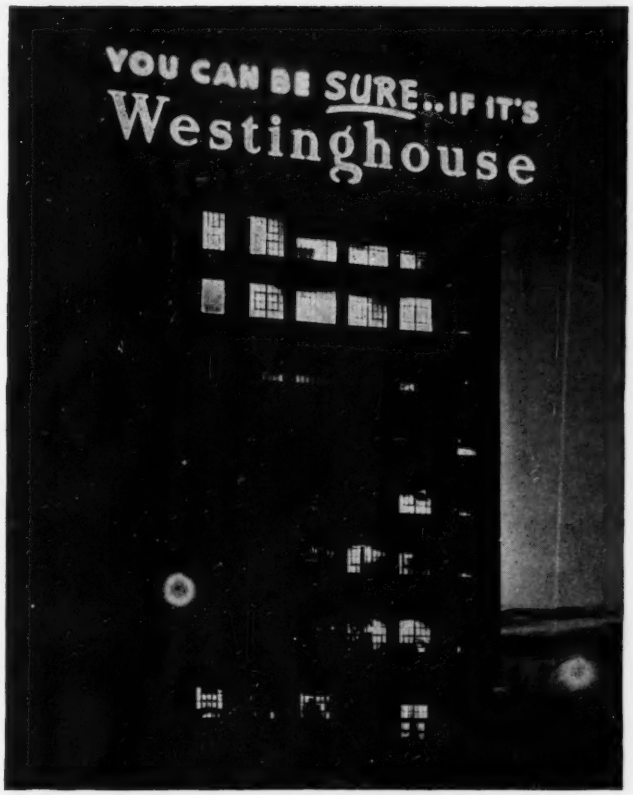
UNITED STATES STEEL

A Name to Remember



Tomorrow . . . when you start playing for keeps . . . names will assume new importance. Reputations are built on ability to produce . . . effectively . . . efficiently . . . economically . . . built on results delivered.

Since its inception, Westinghouse has recognized this principle . . . has been guided by this premise in each of the thousands of undertakings it has initiated.

In the university, where your work is judged on thoroughness and accuracy, you have learned to rely on Westinghouse laboratory equipment.

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Whether your success is at stake in the college laboratory or in the business world, the broad experience and established reputation for excellence in engineering and manufacturing that Westinghouse has built through the years will be available to you.

As you enter industry, you will meet new problems that will bring you in contact with many types of products, processes and methods. Because Westinghouse products play a vital role in practically every industry, our paths will likely cross many times. We will always welcome the opportunity to serve you . . . guided by uncompromising principles . . . principles that are required to fulfill the commitment . . .

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What would your chances be... in case of a HOSPITAL FIRE?

In case of fire, your chances might not be too good in many hospitals today.

Each day there are *three* fires of record in hospitals and institutions, and in those where fatalities occur an average of *five* lives are lost per fire! Isn't this proof positive that many trusted precautions are not adequate protection at all?

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What most people ignore is that, regardless of the cause of fire, regardless of the building construction, it is the *proper control of fire from the first spark that constitutes full and adequate protection against fire.*

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LOOK FOR THE GRINNELL SPRINKLER HEADS ON GUARD

In hospitals, as well as in hotels, theaters and factories, there is a moral obligation upon management for the utmost in protection of life. For your own sake ask about it in your hospital or the hotel where you stop, the schools your youngsters attend, the plant in which you work. Everywhere, look for the famous Grinnell Sprinkler heads — your assurance of positive fire protection. Grinnell Company, Inc., Providence, Rhode Island.

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ENGINEERING GRADUATES HAVE FOUND ATTRACTIVE OPPORTUNITIES WITH GRINNELL

HOW BIG

SHOULD AN OIL COMPANY BE ?

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HERE IS A STRAIGHT ANSWER FROM ONE OF THE OLDEST COMPANIES IN THE INDUSTRY:

Socony-Vacuum is the size that it is — neither the biggest nor the smallest in the Petroleum Industry — because it is an efficient size for the kind of business we do.

Efficiency **is the key to a company's size — for it is the key to what the American public wants, the most for its petroleum dollar.**

Under the American system of business, a company that operates *inefficiently* soon *loses business* to other companies able to offer the public more value at lower cost. That's how American competition works — and if any company gets so big that efficiencies inherent in mass operation are more than offset by increasing costs — *competition* will cut that company to a proper size.

To put it another way:

A *company* is as strong as its competitive efficiency —

In turn, an *industry* is as strong as its companies —

And in turn, a *nation* is as strong as its industries.

Thus, *every* company, big or little, must be *"big" enough* to serve the best interests of the people in the area it covers!

***Since 1866*— the Flying Red Horse Companies have practiced *Competitive Efficiency* to supply you with Finest Petroleum products at the lowest possible cost!**

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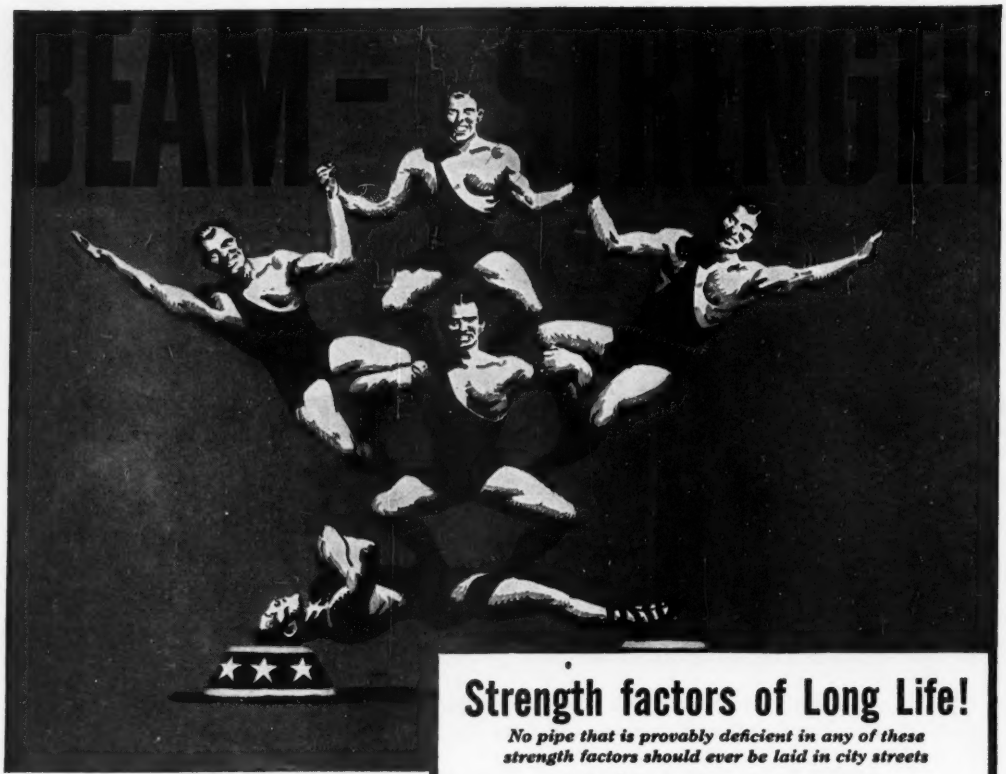

Without beam strength—or, for that matter—without all of the strength factors listed opposite—no pipe laid 100 years ago in *city streets* would be in service today. But, in spite of the evolution of traffic from horse-drawn vehicles to heavy trucks and buses—and today's vast complexity of subway and underground utility services—cast iron gas and water mains, laid over a century ago, are serving in the streets of more than 30 cities in the United States and Canada. Such service records prove that cast iron pipe combines all the strength factors of long life with ample margins of safety. No pipe that is provably deficient in any of these strength factors should ever be laid in city streets. Cast Iron Pipe Research Association, Thos. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3.

CAST IRON

Strength factors of Long Life!

No pipe that is provably deficient in any of these strength factors should ever be laid in city streets

BEAM STRENGTH — When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

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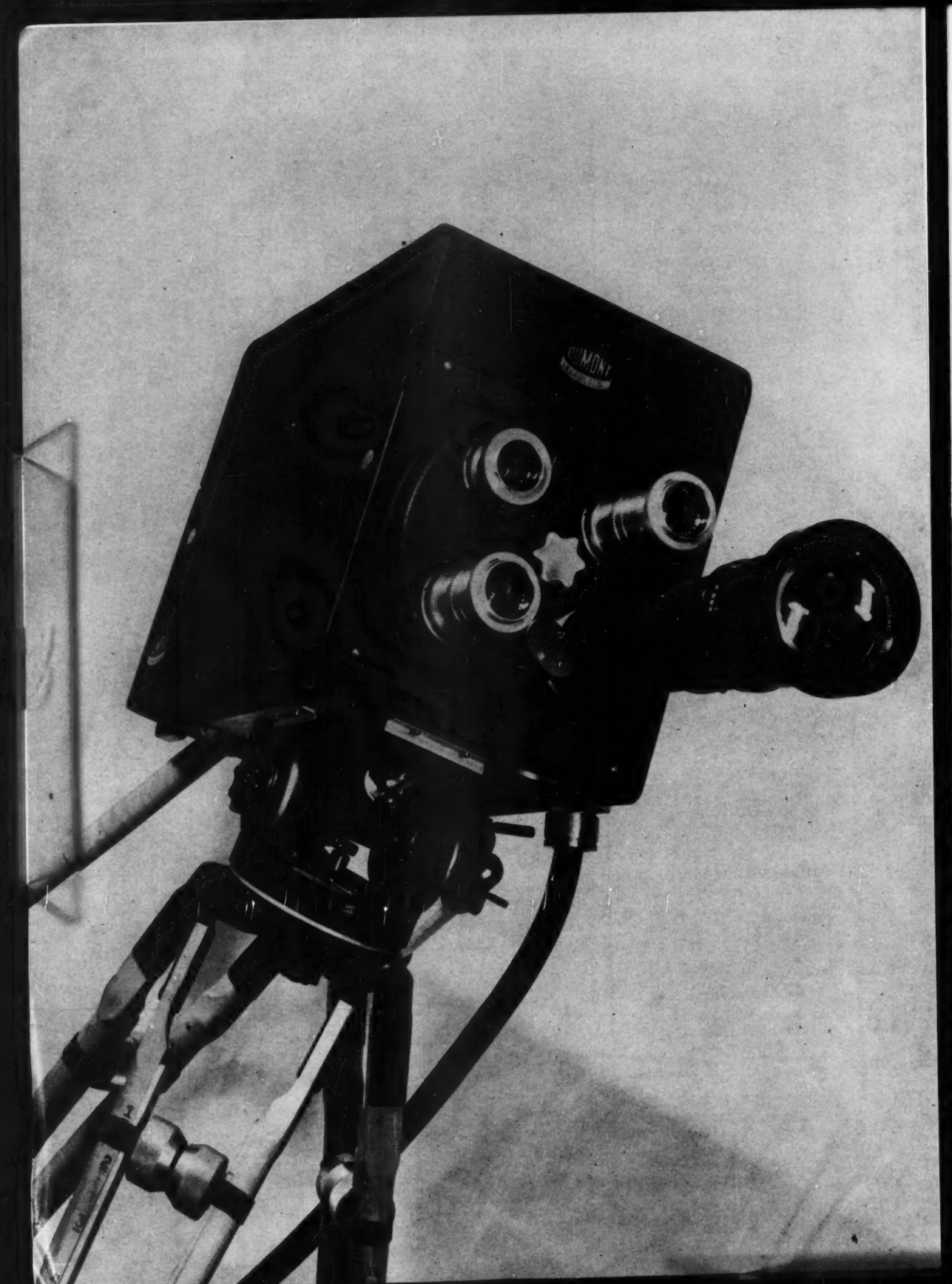

DUMONT

CORNELL ALUMNI

THEIR PLACE IN ENGINEERING

By JOHN F. McMANUS, C.E. '36

Tables drawn by Stanley P. Cohen, CE '52

THE relative status of various schools of engineering is frequently presented with great vigor by partisans of such institutions, but seldom do the resultant claims and counterclaims bear much documentation. Since the actual measure to be used to determine status can consist of many factors, the whole matter often is sufficiently indefinite to give almost every adherent something to which he can cling.

However, at the core, the record of achievement of its alumni is the substance of which the reputation of a school is built, and is a true indicator of both the soundness of its educational activity and the manner in which it fosters the qualities of leadership. It will be satisfying for Cornellians to take note, therefore, of a statistical study of the performance of graduates of a large number of American colleges over a period of years, based upon listings in *"Who's Who in Engineering"*. The eminent position of Cornell alumni in these analyses is high tribute to their individual abilities and to the long tradition of engineering at the University.

In 1932 Dr. Donald B. Prentice, President of Rose Polytechnic Institute, undertook to tabulate the collegiate backgrounds of the full listing of engineers in the 1931 edition of *"Who's Who in Engineering"*. The results of his study were published in the October 1932 issue of *"Mechanical Engineering"*. Subsequently, he prepared similar tabulations on the basis of the 1937 and 1948 editions of this reference book, which were carried in the March 1938 and May 1949 issues of *"Mechanical Engineering"*. In each of his studies Dr. Prentice totaled the number of graduates from each institution and listed them accordingly. A second table presented these totals for a number of the larger representative technical institutions as percentages of total living alumni. Portions of these tables have been extracted and arranged in adjacent columns in this article to give a quick summary of some of the major values carried in the three separate studies.

GRADUATES LISTED IN "WHO'S WHO IN ENGINEERING"

	1948	1937	1931
M.I.T.	933	761	664
CORNELL	667	611	562
MICHIGAN	585	460	385
ILLINOIS	450	364	295
PURDUE	384	309	254
WISCONSIN	357	305	269
CALIFORNIA	299	229	207
OHIO STATE	299	254	192
COLUMBIA	281	292	281
YALE	270	270	256
MINNESOTA	269	182	157
HARVARD	234	200	190
KANSAS	219	124	119
PENNSYLVANIA	213	197	179
IOWA STATE	211	171	144

Table 1

Since differences in size and age of institutions naturally tend to influence the total numbers of graduates distinguished by a special listing of this kind, the proportion of alumni so listed in terms of total potential is especially interesting. An analysis on this basis is presented in Table 2. In the original studies, Dr. Prentice indicated such an analysis only for a group of technical schools because of the difficulty of separating engineering degrees from other degrees at universities and colleges; thus, the resultant "per cent of living alumni" tables did not correlate with all of the top schools in the Table 1 listing of total numbers. Cornell, Michigan and others, for example, were not included in the original Table 2 analyses.

In order to represent Cornell on a similar basis for this article, computations have been made of the total Cornell listings in Table 1 against the total number of first degrees in engineering conferred by Cornell up through the respective years indicated, and these values have been set down in Table 2. For each of the Cornell values the base is *total* engineering first degrees conferred rather than living alumni, since these latter figures could not be established definitely for the dates involved. The percentages for Cornell thus are conservative in terms of actual potential.

Dr. Prentice makes a number of interesting observations in relation to his studies. For example, in the 1948 listing, one-eighth of all college-trained engineers accorded such recognition were alumni of M.I.T. and Cornell, and more than one-third were from the first ten colleges on the list. In all, 362 institutions had one or more alumni listed in 1948. He notes also that surprisingly little variation occurred in the relative contribution of

Image orthicon television tube used for studio and remote pickups. (See Television Programming, p. 13)
—Courtesy DuMont Laboratories

PROPORTION OF LIVING ALUMNI LISTED IN "WHO'S WHO IN ENGINEERING"

	LIVING ALUMNI	1948 LISTED	1948 PERCENT LISTED	1937	1931
CORNELL	12928 (A)	667	5.16	5.97	6.25
M.I.T.	22475 (B)	933	4.15	5.44	4.2
ROSE POLY.	1716	68	3.96	4.61	4.85
WORCESTER POLY.	4265	155	3.63	4.53	4.68
CAL. TECH.	3195	107	3.35	2.73	1.89
MICH. COLL., MINES	2777	87	3.13	6.13	7.27
STEVENS INST.	4800	150	3.12	3.72	3.72

(A) TOTAL ENGINEERING GRADUATES TO DATE.
(B) TOTAL BACHELOR DEGREES CONFERRED.

Table 2

alumni to the lists in his three studies spanning a period of seventeen years.

The significance of a *"Who's Who in Engineering"* listing depends, of course, upon the basis of such listing and the extent to which it is actually representative of professional recognition. Dr. Prentice outlines the procedures undertaken by this publication for establishing its listing, which include distribution of questionnaires to all available lists of engineers, and a testing and screening of the resultant information against criteria such as records of professional responsibility, acknowledged eminence, various indicators of achievement, and so on. Obviously there remains the chance that some persons entitled to listing will not be reached, and that others will neglect to return the questionnaire or will prefer not to be included. For example, a random check indicates that a number of the most prominent Cornell engineering alumni in business and industrial executive positions are not listed. This is presumably because they have discontinued professional society affiliations from which questionnaire contacts were made, or because they did not wish to be so listed, perhaps feeling that their present activities did not place them in an engineering category.

Nevertheless, *"Who's Who in Engineering"* probably contains as complete a file of engineers of recognized standing and achievement as can be compiled. It would seem to be a sound and comprehensive basis for the kind of study undertaken by Dr. Prentice.

The distribution of the total number of listings by year of graduation indicates that maximum professional achievement, or at least recognition, covers a period of about twenty to forty years after graduation. This is strong evidence of the importance of creating a firm basic foundation in the engineering training period as opposed to excessive emphasis on contemporary practice.

Dr. Prentice calls attention to the inclusion in the total list of a fair share of graduates of institutions which do not offer engineering curricula. For the most part such men probably are science graduates who have entered engineering practice, or who serve in the area between theoretical and applied science. This again reflects the well-known alliance of engineering and science, but it may also mark a deficiency of American engineering training in terms of scientific strength. It is perhaps significant in relation to the record noted herein that over the years the science requirements for Cornell engineers have been among the most rigid and extensive established anywhere. Certainly the present Cornell five-year engineering program, with its substantial core of scientific and general studies, will reinforce the traditional background of Cornell engineers for the complex technological period ahead.

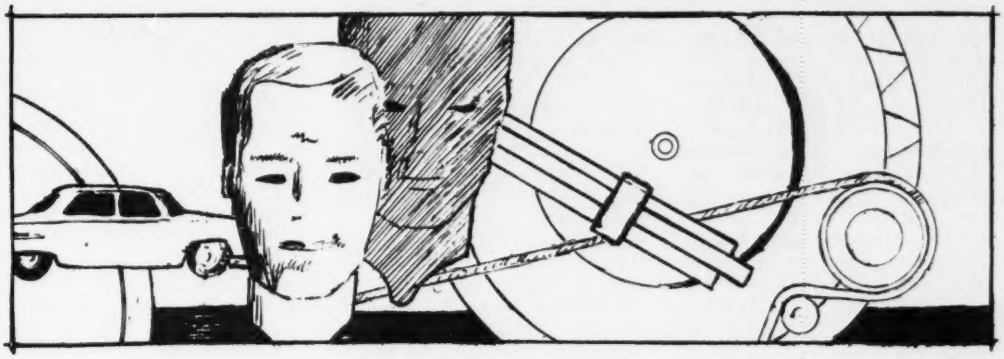
It is satisfying not only to have this record of achievement of Cornell engineers, but to know that the qualities that have brought a high proportion of our alumni to an eminent position in their profession are today no mere legend, but are a dynamic part of the philosophy of Cornell engineering.

THE AUTHOR

JOHN F. MCMANUS

John F. McManus received the C.E. degree from Cornell in 1936. He joined the staff of the Eastman Kodak Company in Rochester, New York, as assistant engineer, and worked on the design and construction of a number of buildings and plant installations. In this period he also conducted studies on concrete and building materials for special purpose use in the photographic and chemical industry.

In 1940 he went to Buffalo for the establishment of Cornell's Engineering Defense Training Program and subsequently acted as resident administrator of Engineering, Science and Management War Training. From 1945 to 1948 he was in charge of engineering planning for the Sheffield division of National Dairy Products in New York, and then returned to Cornell as administrative assistant to Dean Hollister. He is a member of Tau Beta Pi, Chi Epsilon, and Phi Kappa Phi, and of ASCE.



THE HUMAN SIDE

By JOHN R. BANGS, M.E. '21

Illustrations by Dana Lee, Arch '53

The Problem in Industrial Engineering Exists Not With Machinery But With Employee Relations

The human side of industrial engineering opens up many fields. To begin with we are all different. Every individual is not uniformly superior, average or inferior in all traits, but a combination of superior, average and inferior traits. Plato voiced this truth over 2000 years ago when he said: "Citizens, you are all brothers, yet God has framed you differently."

I am sure you will agree that we cannot engineer a human being; and even if we could, it would be wrong to do so. Some one wisecracked, "The human being is an emotional animal who sometimes stops to think." Actually he is a combination of habits, desires and ambitions that respond to the logic of reason and warmth of emotion. He is totally unlike the machine to which engineering is normally applied. So let's speak not of "human engineering" but of "the *Art* of Human Relations," a term everyone can understand.

Industrial engineers are trained to approach problems systematically, according to a predetermined plan, as for example, they:

(a) Collect facts
(b) Analyze information available
(c) Judge its value and significance
(d) Devise plan of action
(e) Put plan into effect
(f) Follow through and check results

Scattered through every step of this procedure we encounter the human element. Since the purpose of most industrial engineering is to benefit human beings, it is apparent that there is not only a human side to industrial engineering, but that it is the *major element* in solving most industrial engineering problems.

Collecting The Facts

Let us consider the rather common fact-collecting procedure of taking a time study and the extent to which the human side is involved. Basically most such studies have as their ultimate purpose the setting of a standard labor task for the operator to meet. The reactions on both sides are interesting.

How natural for the operator to be suspicious of the study. He has fear in his mind—fear that in some way this study might affect his effort, his earnings, or even his job. What is more human than for him to follow the impulse to hold back?

The observer is influenced by equally human reactions of his own. Distrust may be a moving factor. Fear of censure for a loose time study may cause him to level or grade down the performance. This would work hardship on others if the data were accepted as fact.

Much has been written about how to proceed to avoid the effect of reactions such as these when making a time study. Some experts ridicule the time study systems and expound on the merits of compiling basic motion elements previously determined under controlled conditions. Both systems have their merits and their application but neither will accomplish the fundamental purpose unless applied with human understanding.

Superior results are generally obtained because the time study observer had a human slant on the operator he was studying. Perhaps it was a friendly discussion of the study before it started, or a word of encouragement as it progressed. Or it might have been understanding that the fumbles were due to attempts to work fast rather than deliberate attempts to deceive; or observing that one operator is inclined to speed up during a study while another will slow down.

And last, but not least, getting the facts might depend on the observer's knowledge of the skills and limitations of the operator being studied. A capable operator on slow, heavy operations might fail badly on a high speed hand operation through no fault of his own.

We cannot forget that the operator, too, is judging his judge. What does he know of the time-study man? Is he critical? Is he fair? Does he grade too closely? Does he leave out essential elements? Can he be trusted to level accurately? If the operator has a good opinion of his observer, he can usually be trusted to give a good study.

Analysis and Judgment of Data

One of the principal problems confronting the industrial engineer who analyzes and judges data, is a proper appreciation of the human aspect involved in its collection. Consider for the moment sales information used as the basis for a new plant or layout for a new product.

Everyone is optimistic. The new design will correct all of the production difficulties of the past. Sales will boom and quotas will be exceeded and before long, more dollars will go into the set-up than will ever be written off. Why? Because people are human. They like to believe the things they want to believe.

Once again the industrial engineer is called upon to analyze the data and judge it in the light of these human tendencies and to proceed accordingly. In these analyses more than strict technical judgment is involved. Human judgment, usually called common sense, is also needed. "Science," said Oliver Wendell Holmes, "is a first rate piece of furniture for a man's upper chamber, if he has common sense on the ground floor." If you never lose sight of the human factor in your work, you may find that common sense is just simple understanding. It may even enable you to overcome the handicap of a technical education.

Plan of Action

Before we can take our data and formulate a plan of action, we must visualize our product moving through the plant. We must see and feel the people at their work, in their particular surroundings, at every phase of the process. Never forget every worker is an individual human being. What is an easy job to a phlegmatic, slow-moving Swede will drive a temperamental and highly nervous Latin to distraction. We each have our various talents.

When planning we can easily keep in mind the quantitative data which insures capacity or output, but our plan still hinges on whether everyone involved is functioning as required. What can be done to insure that they are?

For example, the plan might involve a new layout or process with people to operate it. Have the physical demands on the operators been checked? Do they lift excessive weights? Are they always "fighting" the tools? Are they bending over or reaching all day when this

THE AUTHOR

Mr. Bangs graduated from Cornell in 1921 with a degree in Mechanical Engineering, after which he did special graduate work in Management and Psychology at Columbia and at New York University. He returned to Cornell and rose through various academic posts, finally becoming Professor of Administrative Engineering and head of that department in 1931.

John R. Bangs

In 1929, Mr. Bangs was named a member of the Editorial and Consulting Staff of the Alexander Hamilton Institute. He is a long-time member of the American Society of Mechanical Engineers, having been chairman of the Management Division Executive Committee in 1943, and is on the Standing Committee of the Professional Division. During World War II, he acted as technical consultant to the War Manpower Commission. Mr. Bangs joined The Budd Company in 1943 and is now Director of Industrial and Personnel Relations.

A prolific author, Mr. Bangs has published numerous articles and reports, as well as several technical books. He is a member of several engineering honorary societies, and the American Society for Engineering Education, the American Management Association, and the Industrial Relations Committee of the Philadelphia Chamber of Commerce.

burden could be reduced? Is the light good? How is the ventilation? Does the work ruin their clothes? Is it safe? These and dozens of other angles are the industrial engineers' responsibility, whether he is designing or approving the plan of action. Just because an operator can "stand" certain working conditions is no sign that they are right or economical in the long run. Recognize an individual's personal limitations—it always pays.

Putting the Plan Into Effect

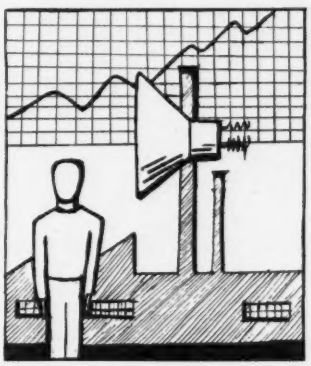
How often have good plans failed to produce because of the way they were put into effect? Various obstacles are bound to be encountered. The first obstacle is that very human tendency to resist change. It may be as simple as asking an operator to sit down when he had been standing up to do his work. It may be that you want him to work on the other side of the table. And at once your plan will receive its first setback.

Don't be indignant over it. You may start to overcome this resistance by selling the reasons back of your plan, and in most cases, the men will adjust themselves to the new conditions without serious complaint.

On the other hand, some plans, no matter how excellent their purposes may be, cannot and should not be put into effect all at once. Often this is true when actual experience is required. Learn, in such cases, to recognize the difference between legitimate complaints that can be used constructively, and the anticipated variety of fault-finding complaints due to the plan's newness.

The scope of the work is important. Since the object is always success of the plan in the shortest possible time, the industrial engineer is often asked to decide upon the extent of the installation to be made. Countering the natural desire to do it all at once is the reaction of the men involved in doing the work. Quick success is often essential to their continued support. Don't bog them down with an excessive unfamiliar load.

Take some part of the plan, preferably one rather certain of success, and make it work. We know that the outcome of an entire plan often hinges on the outcome of the first trial. Some years ago, I was helping to install a piece-work system in a large Middle-West plant. Expecting antagonism, I approached my job cautiously. Imagine my surprise when workmen stopped me on the floor and begged to be time-studied. I should have known the reason. The installation in other departments had been highly successful, and everyone



wanted to participate in the increased earnings possible under the new piece-work setup.

This rule should not be applied when analysis indicates that immediate and complete success of all parts of the plan are highly improbable, or when the plan itself is not too definite or well supported. Here we can take exception to the above suggestion.

In this case, the best method is to launch three or more parts of the plan simultaneously. Then chances are good that all will not fail. Even if the gains are small, collectively they add up. This practice is often of value in waste reduction programs and safety drives. It may be used, too, when there is doubt about the outcome of a repetitive operation.

The Follow Through

Our last logical step in effecting a change is to follow that change through until it becomes a permanent part of plant procedure. Sometimes changes are slow in taking hold. Old General Inertia and his leaden soldiers bar the way to progress. The actual functioning of the plan must be checked from time to time to make sure men are doing what they are supposed to do.

To insure success of the new plan time must be taken to explain it, enlist support for it, and then to delegate responsibility for carrying it out. If the men can be made to feel that the plan must succeed for their own benefit, more often than not they will see it through and insure its continued success.

Resistance To Change

Let us return now to explain our first premise—that any change we propose will be resisted. I believe it was Disraeli who said, "Change is inevitable; change is constant," and Confucius, many years before, remarked, "Only the wisest and most stupid never change." Yet, there seems to be a strange mental insulation on the part of mankind against change.

The industrial engineers, particularly those men who have more recently been graduated, equipped with a splendid technical training and imbued with an enthusiasm for applying it, run counter almost immediately to this fundamental human trait. You meet it in the shops, and in the offices; in engineering departments, and even in the higher administrative levels. Mr. Kettering's famous remark that it takes four years to get a new idea across to a Board of Directors is indicative of how far reaching this resistance to change may be.

Having planned your course of action, and embarked on it, always remember the human element involved. In your daily contacts with men in the shop do all you can to spread helpful information and lift morale. Avoid like poison anything in thought, word or deed that might lead to the destructive human emotions of hatred, suspicion, resentment, anger or fear. Cultivate instead the positive feelings of enthusiasm, loyalty, duty, justice and understanding.

General Omar Bradley once said, "We are living in a world of nuclear giants and ethical infants." To paraphrase the General's words, we are living in a world of atomic giants and human relations infants. And why? Because we have not come to real grips with our problems. The art of human relations remains the great unexplored frontier of our times.

FIFTH YEAR PROGRAM

FOR

ENGINEERS

Editor's Note:—

In June, 1951 the first class under the five-year curriculum will graduate from the C.E., E.E., E.P., and M.E. Schools.

Featuring a broader coverage of both technical and non-technical subjects, and a challenging fifth-year project designed to crystallize the theory learned in the preceeding work, the five-year curriculum is something of which we all should be justly proud.

Recently the ENGINEER made a survey of the preparations members of the Class of '51 are making in the various Engineering Schools to prepare themselves for their last year at Cornell, which is the inaugural fifth year of the new program. The findings are presented here.

ENGINEERING PHYSICS

Number of students in fifth year next year—15

The E.P. School will assign from three to six credit hours to the project, depending upon the amount of work the student does. Projects will be conducted by individual students. The student is allowed complete freedom in the selection on a project topic, the only requirement being that he choose some project within his realm of accomplishment. After discussing the project with Professor Cuykendall and obtaining his approval, the student will then be assigned to a certain faculty member as project advisor. Professors in any school may be chosen as advisors.

The students are being informed individually of the requirements of the fifth year by Professor Cuykendall; no formal meeting of the class has been necessary.

The present E.P. program lists only six required hours in the fall term and three in the spring of the fifth year. The student is expected to take most of the remaining hours in courses relating to his major field of interest. Credit requirements of the project remain flexible.

Said Lloyd P. Smith, Chairman of the Department of Physics and Engineering Physics, "The idea of a fifth year is to foster independence of work by the students, rather than merely further taking of courses." The fifth-year program of the E.P. School has been laid out in accordance with this idea.

MECHANICAL ENGINEERING

Number of students in fifth year next year—49

The M.E. School is offering projects in the following general fields: industrial and engineering administration, heat power engineering, machine design, materials processing, engineering materials, and mechanics. At a Class of '51 meeting held just before the Christmas vacation the respective department heads outlined to the students the nature of suggested project work in each field, and mimeographed material was distributed to each student explaining in detail the topics offered by the departments. Projects will, in general, be group undertakings, involving two or more men, and may involve more than one department or school of the University. The M.E. department heads are in charge of projects in their field, and will assign each project group to a specific faculty member for supervision.

The project itself is assigned a total of six credit hours, which may be divided in any manner between the ninth and tenth terms. At present, Class of '51 M.E.'s have chosen the general field of their project work, but are still deciding the specific nature of their projects with the help and advice of the faculty. Complete freedom is allowed the student in deciding the type of project work he wants to undertake.

CIVIL ENGINEERING

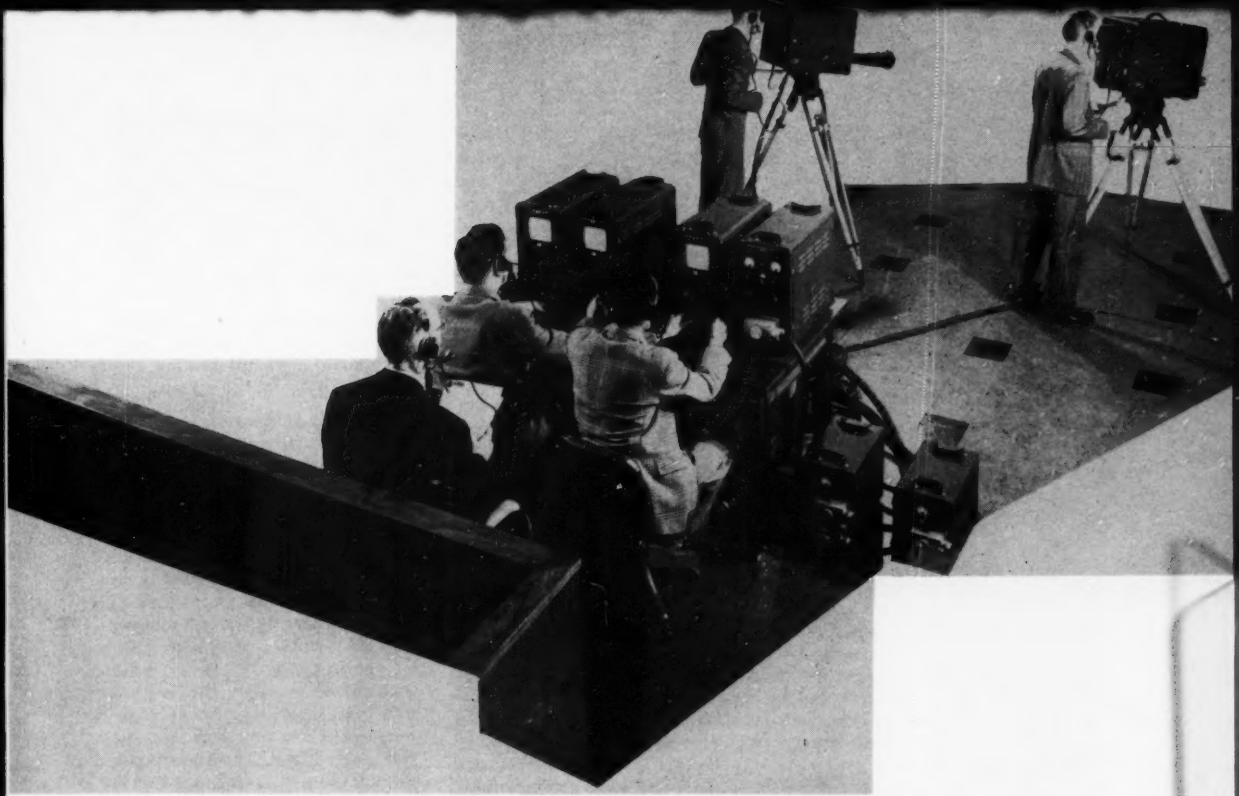
Number of students in fifth year next year—43

The five-year program in the C.E. School does not require a project in the fifth year, but does offer a completely revised curriculum which has been broadened to include many more practical and theoretical engineering subjects, and also to allow for a wider choice of electives. Twelve hours of electives are allowed, for which the student is allowed complete freedom of choice. The whole program has been carefully evaluated, and is designed to give the student a broad, thorough coverage of the field of civil engineering and related topics.

ELECTRICAL ENGINEERING

Number of students in fifth year next year—30

The project and courses related to it will form a major portion of the E.E. student's fifth-year work. Fifth-year project plans are being made by a committee under the direction of Professor C. L. Cottrell. Suggestions for project titles were made by various professors, and were considered in relation to cost, availability of facilities, and desirable supporting courses. A list of 47 topics has been made up from these suggestions, for the use of students in choosing projects. Topics are divided into three option areas; power, controls, and communications. In general the projects involve library work, measurements, construction of apparatus, or combinations of these; the time allotted for the work is six credit hours during the year or about 270 hours.



TELEVISION PROGRAMMING

By DAVID SCHERAGA, EE '54

Since television came into its own in recent years, enormous strides have been taken to improve program production techniques for this new medium. Most of the major problems faced in the beginning have already been eliminated, but those resulting from deficient equipment, and lack of money and of experience still remain.

Television requires production techniques vastly different from those employed in radio, the legitimate theater and the movies. While the usual problems of cast, script and direction are encountered, new ones such as insufficient rehearsal time, limitations of the camera and other equipment, and the need for new makeup techniques are constantly cropping up. In addition, the television medium is subject to a far more critical audience, which reacts differently when in the relaxing environment of the home than at the theater where hundreds of strangers are present. Television programs must therefore be geared to and maintain the usual intimate mood prevalent in the home.

Transmission Elements

Before discussing the many aspects of modern programming, some of the elements necessary to transmit a television show should first be considered. The television station consists of a complete sound broadcasting system and picture transmission system, operating as independent electrical units.

Beginning with the picture system, whose function it is to pick up the scene being televised and convert it into a suitable electrical signal, attention is first focused upon the camera. The camera contains the pick-up tube for converting light into electricity. This tube along with the cathode ray tube in the receiver actually comprises the most important part of any television system. In fact, the progress made by television transmission over the years follows closely the improvements made in the camera pick-up tube.

From the camera the output signal is fed to a picture monitor. Every camera has its own picture monitor, on which the scene is viewed before it is sent over the air, so that any necessary adjustments may be made on the camera to improve signal quality. Keying signals, which control the motion of the scanning beams in the pick-up tube and monitor receiving tube, are fed simultaneously by a synchronizing generator to both the camera and monitor. In the mixing and distribution amplifier the keying and camera output signals are combined to form the television signal. The signal is then fed to the transmitter to modulate the television radio frequency carrier, and finally to the antenna where it is radiated.

The sound, meanwhile, is picked up by the microphone, amplified, monitored and fed to a sound transmitter. From there it may be radiated from a separate antenna or from the video antenna.

Actually, a modern television station is much more complex than the simple system outlined here, but this description indicates some of the more important elements required in preparing a television show for transmission.

Programming Units

Now consider the studio itself where the program is actually created. The studio is composed of several distinct units, each of which depends upon the others to achieve a well-coordinated program. First of these units is the camera.

Two to four cameras are usually used in the studio. They are of the iconoscope or image-orthicon type, the latter being used more because of its greater light sensitivity. Image-orthicon cameras are usually equipped with three or four lenses which are mounted on a rotating turret to permit rapid changing. There are generally two-inch, three and three quarter-inch, five-inch, ten, and twelve-inch lenses on the turret. A two-inch wide-angle lens is used for long overall shots of the scene, three and three quarter-inch and five-inch lenses for medium shots, and ten-inch and twelve-inch lenses for close-ups.

There are three general types of cameras. The first, the stationary type, is operated by one man and remains fixed during the show once it has been set into position. However, the camera head is movable either up and down or from left to right. The second type, the dolly camera, is a variation of the first and is used for moving in and out of a scene while the show is on the air. It requires two men to operate it since one is needed to move the camera and keep the cables clear while the other operates the camera head. The last type is the boom camera, which is also operated by two men. This camera is mounted on an adjustable boom to obtain angle shots from above or below eye level.

The men who comprise the camera and studio crews must be well trained if smooth running programs are to be produced. If, during the course of a program one or two mistakes should occur, the effect of a good show may be spoiled and all the hours of careful planning and rehearsing will have gone to waste. Unlike the moving pictures, a scene cannot be reshot in television; it has to be done right the first time. The man responsible for the actions of the studio crew is the stage manager, who runs the production from the floor and whose duty it is to give the performers their cues. In a typical studio he would have under him a crew consisting of one or two camera men, an extra to help dolly the cameras, a mike boom operator, property men who change sets during the show, and one or two additional men to assist in moving the equipment about. If a television show is to be run off with split-second timing, the studio crew must not only be familiar with every detail of the production, but must also work well as a team.

Studio control room console for monitoring programs. The technical director and program director sit here and watch program through window.

—Courtesy DuMont Laboratories

Scenery and Staging

The scenery used in television is very similar to that employed in the theater. However, certain new techniques had to be developed for this medium to overcome occasional shortcomings of the equipment.

The basic piece of scenery is called the flat. It consists of a wooden frame covered with a heavy material such as canvas. Since scenery changes must be made quickly once the show is on the air, the flats are simply propped into position and held steady with an easily removable brace. Another important device is the painted canvas backdrop which looks surprisingly realistic when viewed on the receiver screen. A good backdrop will possess the following qualities: It has contrasting lines that register well on the screen; it concentrates the viewer's attention on the action in the foreground by being simple in composition; and it also looks well in both close-ups and long shots.

The art of painting scenery for television requires a thorough understanding of the camera's color sensitivity and resolution. The camera does not record detail as well as a movie camera does. Therefore, illusion can be easily obtained because of the lower resolution of the television system. The problem of choosing the proper colors for scenery was one which presented some difficulty at first. The television camera will not reproduce all colors in their equivalent shades of gray on the receiver screen. The iconoscope responds well to most colors except red. Red seems to have a washed out appearance on the screen and for this reason it must be avoided in scenery, clothing or make-up, when this type of camera is used. The image-orthicon camera on the other hand will re-

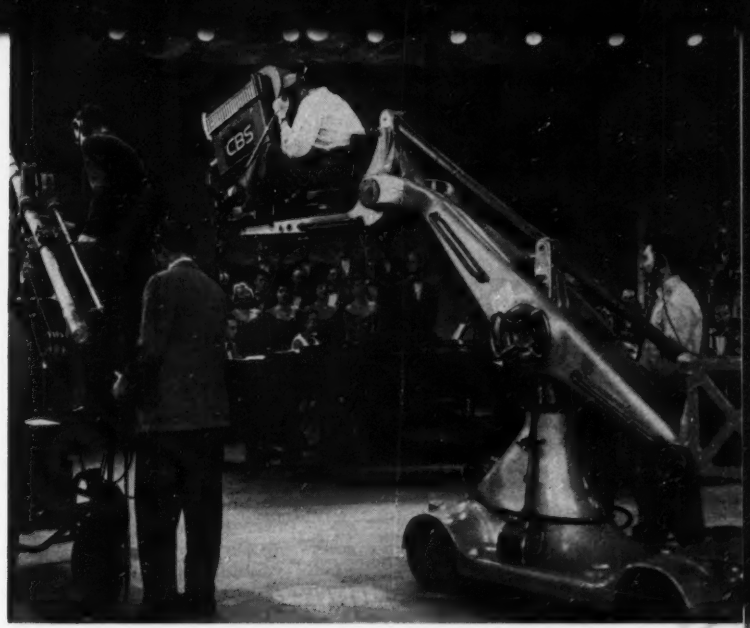
spond well to most colors except blue, to which it tends to over-respond. For example, the bluish beard lines on the male actor's face (even if he is freshly shaven) tend to show up darker than they really are, giving the actor an unkempt appearance. This may be corrected, however, by the use of proper color make-up. After careful experimentation, it was found that shades of grey tended to produce the least color distortion.

Two very effective staging devices that are becoming increasingly popular are projected backgrounds and miniature sets. Projected backgrounds are simply made by projecting a scene onto a translucent screen which serves as the back wall of a set. They eliminate the need for painted scenery and thereby lower production costs. Miniature settings are popular because they make it very simple to show such scenes as the burning of a building, an overall view of a city, or a fleet of ships at sea. When picked up by the close-up camera, they appear quite realistic.

The problem of lighting was one which caused many headaches at first, but many of these difficulties have been overcome with the advent of the image-orthicon camera. With the iconoscope camera, forty to fifty thousand watts were needed to properly illuminate a scene. So much heat was developed fom these lights that it became exhausting for the actors to work under them for any length of time. The image-orthicon camera, on the other hand, requires only twenty-five hundred to five thousand watts to fully illuminate a studio set. A great part of the light comes from lighting units above the set. The remainder of the lights are mounted on dollies which may be moved about during the show to achieve special lighting effects. Occasionally a spotlight is used in conjunction with the overall lighting to highlight a specific performer or area.

Camera Techniques

A television show would rarely be successful if it were not for good camera technique. The camera is an extremely versatile instrument and can be used to obtain a wide variety of shots which liven up a program and often make the difference between a good or poor show.



The Fred Waring Show is shown being televised with a new, more mobile camera unit. The camera, known as "Gargantua," can be swung to a height of 12 feet and laterally through 360 degrees. *—Courtesy General Electric*

Of the many camera techniques the simplest is the "clip", which was borrowed from motion pictures. It involves switching, almost instantaneously, from one camera to another with no perceptible delay on the screen. The dissolve and fade-out are two other popular devices borrowed from motion pictures. The former involves fading down one camera as the other one is brought up so that both pictures appear momentarily together on the screen. In the fadeout, one camera is faded completely to black while another is brought up from black. The effect is much the same as a curtain being lowered in the theater.

One of the more effective specialized effects is the superimposition which occurs when two cameras are on the air at the same time. The superimposition is especially effective in tying together action taking place at two different points or in picturing "throwbacks". In addition, one of the images may be made more intense than the other so as to focus more attention on it.

De-focusing is a technique used primarily to create mood. When changing from one scene to another the image is gradually thrown out of focus until nothing more is perceptible. This type of switch gives the stage-crew and performers a few moments to prepare for the next scene.

In addition to the special techniques, there are certain standard devices which are commonly used. The three most popular are the close-up, the medium shot and the long shot. As their names indicate, they differ only in the relative area they cover.

The first terminus of all effects, both video and audio, is the studio control room. Here the camera pictures are monitored and the sound levels adjusted. From the studio control room the program goes to the master control room, the nerve center of the television station. In the master control room, programs are not only picked up from the various studios in the station, but also from network stations and from remote pick-up crews. The master control room performs such important functions as the integration of the sound with the picture, the proper shading of pictures and the selection of sound and picture programs to be broadcast.

Present Limitations

The problems of creating and producing a television program fall

(*Concluded on page* 28)

PROMINENT

Professor Sears

William R. Sears

While Professor Sears was working for Northrop Aircraft, one of his associates drew a cartoon of him as an octopus reaching out in all directions for more work. He still seems to live up to this reputation. Besides being Director of the School of Aeronautical Engineering, he is on the faculty of the Department of Engineering Physics. Flying his Piper Super Cruiser to Washington, Buffalo, and other points, is not only a pastime for him but expedites his duties as Chairman of the Panel on Aircraft of the Scientific Advisory Board of the Air Force.

An unusual hobby of his is playing the recorder, the predecessor of the modern flute. He is a member of a recorder quartet made up of Cornell and Ithaca College professors. While many find photography and skiing to be avocations not conducive to family life, Professor Sears finds adequate time to devote to his wife and children, aged four and seven.

He obtained his Bachelor's Degree in Aeronautical Engineering from the University of Minnesota in 1934. Despite the fact that this was during the depression, he secured a research assistantship at the California Institute of Technology, specializing in wind tunnel work. At the end of the first year he was in charge of all wind tunnel work done there. He stayed at Cal. Tech. for eight years, receiving his Ph.D. in 1938 and an appointment as an assistant professor in 1940.

From 1941 until he came to Cornell he was Chief of the Aerodynamics Division of Northrop Aircraft. He did much of the work on the Black Widow and flying wing type planes. Since 1946 he has devoted his energies to the newly founded School of Aeronautical Engineering at Cornell.

Malcolm S. McIlroy

Professor Malcolm S. McIlroy of the School of Electrical Engineering is obviously a man who has been around and seen things; his string of Greek letters and degrees tells very little of the whole story.

His father was an educator, but the academic atmosphere of his childhood apparently failed to interest young Mac in teaching. Consequently, the fall of 1919 found him standing in one of Cornell's famous "lines," waiting for the little white slipstick which was to be his only companion during many a midnight vigil over steaming textbooks. Although consistently an "average-raiser" and "curve-wrecker," ranking near the top of his class, undergraduate McIlroy always seemed to be able to find time for the extra-curricular. He held offices of various types in a number of student organizations; but it was as a faithful oarsman on what was then the E.E. crew that he formed some of the most cherished friendships of his college days.

The eight terms passed quickly, and so it was in June of 1923 that M. S. McIlroy, E.E., ventured forth into the world of industry. He engaged in three years of test work immediately succeeding graduation before he accepted a position in the engineering department of the Central Hudson Gas and Electric Corporation. After four years he was transferred to the commercial division, where he learned an important secret of professional success—the technique of getting along with people.

Government socialization of public utilities threatened, however, and after eleven years he decided to seek another field. Subsequently, the M.I.T. faculty added a new member to its ranks, a young engineer whose avowed purpose was to get the concept of cost back into engineering at M.I.T. Professor McIlroy worked for a while with the honor students, but changed over to the M.I.T. Radar School during the war. Finally, when the shooting was over, he was given a year's leave of absence, during which time he successfully completed his thesis for the doctorate. Then, in 1947, prompted by the promise of research facilities and a liking for the old school itself, he joined the faculty of the School of Electrical Engineering at Cornell.

Professor McIlroy

FACULTY

Professor McIlroy is a great "joiner," belonging to campus committees and organizations too numerous to mention. But teaching is a challenge to him—his earnestness in instructing derives from his conviction that the student's interest must first be stimulated.

Charles O. Mackey

Charles O. Mackey is almost synonymous with heat-power engineering in the hallowed halls of Sibley. A native Ithacan, he entered Sibley School of Mechanical Engineering in 1921 after graduating from Ithaca High School. Those were the days "when coeds were banned by fraternity houses, when students studied harder and played harder but less frequently, and when school spirit was heightened by intecollege athletic rivalries."

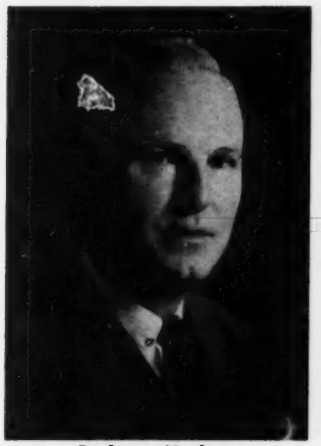
Professor Mackey played frosh baseball, and also went out for the hockey team, but, then as now, there was plenty of snow but seldom any ice, and he soon lost interest in pushing the puck on the floors of the Old Armory. Summers found him working for the Detroit Edison Company, for the Eastman Kodak Camera Works in Rochester, or just sailing on Cayuga Lake. After his junior year, he instructed Mech Lab, tutored several courses, and graduated with the degree of Mechanical Engineer in 1926. He remained at Cornell to become a full professor in 1936 and was appointed head of the Department of Mechanical Laboratory in 1942 and of Heat-Power Engineering in 1947.

Professor Mackey found enough time to become a heavy contributor to technical journals and handbooks, and he co-authored and wrote several books, including "Graphical Solutions," "Air Conditioning Principles," and "Thermodynamic Charts." He is currently revising the heat-power engineering text by Barnard, Ellenwood, and Hirshfeld.

Air conditioning and refrigeration are his main fields of endeavor, as evidenced by his consulting services for the John B. Pierce Foundation, the Carrier Corporation, and the Orange Crush Company. In addition to holding several patents on refrigeration, he has investigated the performance of baseboard radiation and convectors for Utica Radiator, Sears, U. S. Radiator, and the Convector Manufacturers Association. He has also helped devise a sol-air thermometer, which measures the combined effect of temperature, air movement, and the sun's radiation, all of which are factors in determining the summer cooling load for buildings, and is currently working on a fluid analog for periodic heat flow through structural materials, another cooling load project.

Aside from his numerous research

Professor Bijlaard



Professor Mackey

projects, Professor Mackey helped organize the Statler Club, and serves on the Committee on University Policy and as faculty adviser for crew. An ardent fisherman, he has angled from Nova Scotia to Florida, catching many a rainbow trout in this region in the early spring. His trim physical shape may be attributed to some fast sets of tennis and brisk rounds of golf.

Professor Mackey is a member of the Council of the American Society of Heating and Ventilating Engineers, several of their research technical advisory committees, Tau Beta Pi, Sigma Xi, Phi Kappa Phi, American Society of Refrigerating Engineers, American Society for Engineering Education, and the American Association of University Professors.

Paul P. Bijlaard

Professor Paul P. Bijlaard, one of today's foremost structural engineers, has in one year at Cornell grown to be a familiar figure in the School of Civil Engineering.

Born in Holland, December 2, 1898, he received his education there and graduated as a civil engineer at Delft in 1920. His initial work in that field was with the Department of Bridges and Structures of the State Railways in the Netherlands East Indies, where he designed several bridges which utilized his own original devices.

From 1928 on he served as Professor of Bridge and Structural En-

(*Concluded on page* 38)

Cornell Society of Engineers

107 EAST 48TH STREET 1949-1950 NEW YORK 17, N. Y.

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L. P. Smith, Director of the Department of Engineering Physics

William Littlewood

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

Presidents' Message

Well, here we are, rounding out another year for the *Cornell Engineer*, for *Cornell* engineering, and for the *Cornell Society of Engineers*.

For the *Cornell Engineer*, congratulations on some of the best issues of its history. All credit and honor to Dave White and his staff, who retired this Spring after a consistent series of excellent productions. And now, all help and cooperation for Tom Kelly and his new staff, to keep up the good work and perhaps set a new and even higher standard!

And for the *Cornell Society of Engineers*—the *Annual Letter* deals in some detail with the year's hopes, ventures and successes. Everything was moving along in great shape until Christmas. A new, lusty *Chicago* Section! The other Sections reporting fine meetings and good progress! A couple of excellent meetings and interesting programs in New York! Great plans for close cooperation and liaison with the campus, and for a full season, after the first of the new year! And then—my own program blew up in my face, and I found myself on an enforced vacation with plenty of time to think and observe the actions of others!

But that has proved a blessing in disguise. For one thing, we come to realize that life can be very full and interesting no matter what our physical restrictions. We normally spend our time so preoccupied with a few small areas of human activity that the world seems to stop temporarily when we are denied them. We gradually come to see, however, that thousands of activities, which are the normal fulfillment of other people's lives, are still available to us—and then we are truly thankful for breadth and scope in our training and education—formal and otherwise.

But, even more important, we quickly come to appreciate the close associations we have previously formed with others in fields of mutual interest and endeavor—our relatives and personal friends, of course, but also our business associates and friends, our old college chums, and last, but far from least, our fellow members and workers in club and society activities. And right here I want to pay tribute to the fellowship and loyalty of my associates in the *Cornell Society of Engineers*. Bob Smith picked up the President's Message from Christmas till now. Creed Fulton again took on the campus liaison. Paul Reyneau carried on in all activities, as usual. And all the officers, committees and members went to work at home and afield to make it a better year for the Society than it could otherwise have been. And far from making me feel non-essential, as it probably should, it has filled me with a deep sense of appreciation for them all, and for what the Society represents.

As long as there is a Cornell engineer who does not join with all other Cornell engineers in the broad technical and fraternal objectives and activities of the Society there will still be a lesson for him to learn in achieving the most from his engineering training and career!

Good luck and active membership to you all!

WILLIAM LITTLEWOOD

Paul Goodwin Brown, E.E. '95, has given one-sixth of his estate to Cornell. He died on March 25, in Palm Beach, Fla., at the age of 79. The total value of his estate is not known, but various minor gifts already add up to more than $100,000. One of the nation's top construction engineers, Brown was former president of the Keystone State Corporation in Philadelphia, director and member of the executive committee of Universal Pictures, Inc., a director of ASCE, and a former president of the Engineers' Club in New York.

Fred Asa Barnes, B.C.E. '97, M.C.E. '98, a member of the Cornell faculty for 42 years until his retirement in 1944 and former director of the School of Civil Engineering, died on April 5, 1950, at his home in Pleasant Valley, Conn. He started his teaching career at Cornell in 1902 as an instructor in civil engineering, after doing several jobs for the United States Government in Cuba. He became assistant professor in railroad engineering and surveying in 1905, and from 1915 until 1944 he was professor of railroad engineering. Professor Barnes was director of the School of Civil Engineering from 1921 until 1930.

He was a fellow of the American Association for Advancement of Science, and a member of the American Railway Engineering Society, the Society for the Promotion of Engineering Education, ASCE, Sigma Xi, Phi Kappa Phi, Tau Beta Pi, Chi Epsilon, Pi Gamma Mu, and Zodiac.

The late **Joel D. Justin, '06,** published a new second edition of the well-known Creager-Justin "Hydroelectric Handbook." The revised reference work was released recently by John Wiley & Sons. A consulting engineer for twenty years before his death in February, Mr. Justin was connected with the design and construction of over 100 dams and power plants. His new book is a compendium of information on all phases of modern hydroelectric practice.

Willis Shackelford, M.E. '14, has been granted an extended leave of absence by the DuPont Co. Employed by that company in 1914 as an assistant engineer on the construction of the Hopewell, Va., nitrocellulose plant, he worked in the explosives division from 1915 to 1919, when he was transferred to the DuPont Engineering Co. In 1926 he became associated with the DuPont Rayon Company's operations as assistant manager of the Buffalo rayon and cellophane plants. He later became manager of the rayon plant in Richmond, Va., and was successively assistant manager and manager of the acetate division. He was appointed assistant manager of the Rayon Department in 1947.

Admiral Jelley

Joseph F. Jelley, C.E. '25, Rear Admiral, CEC, USN, was recently appointed by the President as Chief of the Navy's Bureau of Yards and Docks and head of the Civil Engineer Corps. After attending Cornell, Admiral Jelley went to the United States Naval Academy and graduated in 1927, 11th in a class of 594. He received his master's degree in Civil Engineering from Rensselaer Polytechnic Institute, following two years aboard the **USS Arkansas.** During World War II, he was in charge of the construction of the Naval Air Base at Alameda, Calif., and then at San Pedro, before becoming Deputy Director of Construction of the Bureau in Washington. He later assumed charge of the procurement of equipment and supplies for the Seabee program, and went to Guam as Executive Officer of the

(*Concluded on page 36*)

C. E. ALUMNI

The Faculty cordially invite you to the

CIVIL ENGINEERING BREAKFAST

Saturday, June 10, 1950 7:30 to 10:00 A.M.

In Basement of Lincoln Hall

Plenty of food and friends await you . . .

Engineers' Day - 1950

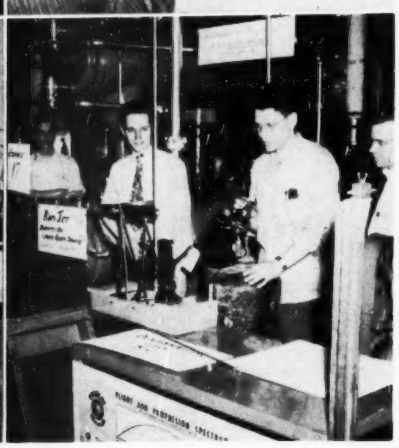
The CE soils testing laboratory on exhibit on Engineers' Day.

Presently at use in the physics department is the electron microscope shown here.

Professor J. N. Jeffreys of ME demonstrates a compression test—of a beer can!

Alfred Blumstein, EP '51, president of the Engineering Council, addressing the Engineering Honors Banquet, while John Laibe, ME '51, the master of ceremonies, looks on.

Cornell's 300-mev synchrotron being explained to visitors by Murray E. Miles, EP '52.



Dave Ross, ME '50, demonstrates the model ram jet engine shown by the Cornell Rocket Society.

By ALFRED BLUMSTEIN, EP '51

Photos by the staff

With the roar of a ram jet's exhaust and the smell of the refrigeration equipment, the second post-war Engineers' Day got under way at 1 p.m. on Saturday, April 29. Playing host to 3300 visitors, including about 250 sub-frosh on campus for the Cornell Day program, the Cornell engineers presented a show which intrigued both the laymen and the professional engineers.

Printed souvenir programs were presented by the Cornell Student Engineering Council, sponsors of E-Day, to all those attending the exhibits. The programs described some of the 150 exhibits presented, in addition to outlining the field of work of the various types of engineers.

The mechanical engineers ran away with the prizes for the exhibits. The Best Exhibit Award, a two-foot high trophy donated this year by the Cornell Society of Engineers, was won by the M.E. School for their design of a workplace layout from micromotion pictures of an old assembly method taken in a nearby plant. They also took first honorable mention for the demonstration of a ram jet.

The C.E.'s took the second honorable mention with their soil mechanics exhibit showing an earth dam seepage model in operation.

The men of engineering physics conducted guided tours about the Newman Laboratory of Nuclear Studies, in addition to presenting demonstrations with Cornell's new electron microscope.

As part of the Chemical Engineering show, a scale model of a plant designed by three seniors for the production of tonnage oxygen was on display in the Olin lounge. The Met.E.'s again ran their demonstrations of casting in the foundry.

Professor M. S. McIlroy's pipeline network analyzer, described in last month's ENGINEER, received much attention from some of city construction engineers who came in for the show, some of them for the express purpose of seeing his device.

On Friday night, before the Engineers' Day festivities got into full swing, the finals of the Fuertes Contest were run off. Six engineers and an architect competed for the $160 worth of prizes, with Doug Anderson, EE, coming up with the top award of $100. Second and third prizes went to Bob Hammon, ME, and John Martin, Arch., respectively.

The engineering schools battled it out on muddy Alumni Field to determine the softball champions of the College. In a situation paralelling last year's contest, the Franklinmen met the Olinmen in the finals, with the double-E's copping the trophy for the second consecutive year.

As a fitting climax to the weekend, the CSEC presented, on Sunday night, the Engineering Honors Banquet, an event very popular and well attended in the late Thirties. Those attending were treated to a thought-provoking talk on the education of an engineer by Professor Clinton Rossiter of the Government Department. Mr. John McManus presented the E-Day awards, in addition to several others received by engineers.

The congratulations of the ENGINEER go out to all those several hundred who had their share in making the 1950 Engineers' Day as much of a success as it was.

Professor W. H. Erickson is shown congratulating Douglas Anderson, EE '50, winner of the Fuertes Memorial Public Speaking Conetst.

Part of EE's display on Engineers' Day was the exhibit shown below.

Techni-Briefs

Gas Turbine Power

A gas turbine, recently installed at the Arthur F. Huey power station of the Oklahoma Gas and Electric Company, is now serving as a source of quick, low-cost electric power for home and industry. Pint-sized when placed beside a steam power plant of equal capacity, it is economical to operate and can reach peak load capacity from a cold start in about five minutes to meet extra output demand.

Power station use of the gas turbine is both new and startling. To date, the performance record of the Oklahoma City gas turbine has far exceeded original expectations. As a single unit, it is rated at 3,500 kw, but it is boosted another 3,000 kw by using its waste exhaust.

This new land power source weighs about 85,000 pounds, is less than 50 feet long and nine feet wide, and requires a shelter building only half the size of that necessary to house a steam turbine and boilers of the same capacity. It uses either low-grade fuel oil or, as in the Oklahoma installation, natural gas.

The long probe gamma survey meter is used to monitor a laboratory safe containing radioactive isotopes.
—Courtesy General Electric

Self-Lubricating Skis

Micarta, the same tough plastic used in Army helmet liners during the war, now promises to enable American ski champions to set new speed records. The president of the Bancroft Racket Company recently announced that his firm is making a new "self-lubricating" ski with bottoms made of Micarta—the laminated plastic developed and produced by the Westinghouse Electric Corporation.

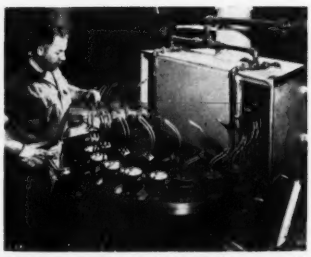
"Since Micarta has a high gloss and smoothness and is best lubricated by water, it has been shown to be an ideal surface for skis," he explained. "By actual tests, the Micarta-bottomed skis—the first laminated plastic-bottomed skis produced in this country—have proved to be faster than the finest skis made entirely of hickory."

Westinghouse plastics engineers report that Micarta is as strong as structural steel for equal weights of cross-section and will add greater strength to the natural hickory to which it is bonded. The plastic is lighter than aluminum of equal strength.

When used on skis, Micarta is self-lubricating, obviating the necessity for waxing, except in very wet snow conditions where snow clings. The Micarta-bottomed skis, because of their toughness, need not be sanded, regrooved, refinished, or relacquered over years of normal service.

Vibration Tester

Working on the old harmonica principle, a new General Electric device tests the strength of metals by vibrating metal strips in the path of rushing air.



This automatic brazing machine speeds assembly of heaters to six times the old rate.
—Courtesy Westinghouse

A harmonica produces its tones when metal strips of different natural frequencies are vibrated by breath blown through the instrument. In the pneumatic tester, compressed air vibrates the test strip until it cracks. The number of vibrations needed to produce failure indicates the metal's strength. On each vibration, the strip intercepts a beam of light, and the exact frequency, or number of vibrations per second, is recorded by an electric eye.

When a test strip begins to crack, its vibration rate slows, and the testing device automatically stops. Engineers then multiply the frequency by the time needed to cause failure in order to find the number of vibrations the metal strip could stand.

The new device, by running tests as high as 1000 vibrations per second, can vibrate metal strips enough times in 24 hours to equal two or three weeks' testing on mechanically-operated testers.

Neoprene Research

DuPont has a new type of neoprene, especially developed for treating paper, and a mill-tested process for adding it to pulp to increase the strength and chemical

(*Concluded on page* 34)

ENGINEERS' LOUNGE

By NOBORU KONDO, ME '51

Photos by Robert Critchfield, ME '53

Amid the cheers of a crowd of eager engineers, the Engineers' Lounge was formally opened at 10:00 a.m. on April 7, climaxing three years of planning and hard work. Dean Hollister unlocked the door to the spacious room in Sibley basement to reveal a neatly decorated—but as yet somewhat sparsely furnished—haven for weary engineering students and faculty members. As a special feature of the opening day, free coffee and doughnuts were served to the several hundred engineers who thronged to see this product of the engineering organizations, notably the societies Kappa Tau Chi, Atmos, and Eta Kappa Nu.

Painted in a relaxing pastel green color scheme and lighted by the soft glow of fluorescent lamps, the Lounge is equipped with such conveniences as coke, candy, and cigarette vending machines. A radio-phonograph console and a tableful of magazines provide additional diversions for the harassed men with the slipsticks. The Lounge is one place in Sibley where men can smoke in peace and comfort without endangering the venerable building.

Dean Hollister shown entering the new Engineers' Lounge.

Besides serving as a central informal gathering place for students and faculty during the day, the Lounge will be used in the evening for meetings and smokers, providing facilities that were sorely lacking in the past. In this way it is hoped the Lounge will bring the students into more frequent social contact with the faculty with a view toward improving student-faculty relations.

Though such a lounge existed in Sibley for many years before the recent war, the Navy used the space for offices during those grim years and the lounge disappeared. With the engineering campus gradually returning to normal conditions after the war, Kappa Tau Chi and Atmos started a campaign in 1947 to revive the Lounge. Since the Greater Cornell Fund drive prevented any solicitations from alumni, the necessary funds had to be solicited from the student body and faculty. About $500 was raised by direct contributions and a raffle, and the renovations were accomplished by the labor of some of the engineering honorary societies.

William Gere, chairman of the Lounge Committee, stated that another $1,500 is needed to furnish the Lounge so that it can adequately serve the 2,000 members of the Engineering College. Thus if every student contributed one dollar, he would be quite certain of finding a place to relax in this sanctuary designed especially for him, the Engineers' Lounge.

Students and faculty celebrating the official opening of the new lounge in the basement of Sibley.

NEW BOOKS FOR ENGINEERS

ENGINEERING MECHANICS. By Archie Higdon & William B. Stiles. 505 pp. Prentice-Hall, Inc., New York. 1950. $5.00.

This text, although it would require major revision before it could be adopted by the Department of Engineering Mechanics at Cornell, does embody the combined teaching experience of the Department of Theoretical and Applied Mechanics at Iowa State College, and can, for that reason, as well as its excellent presentation of subject matter, be recommended to students and young instructors for supplementary reading or home study.

In one respect the text does not claim to be strong. Thus, Professor H. J. Gilkey in the foreward says: "it does not allocate major emphasis on the theoretical aspects and the mathematical technique for dealing with the various situations." On the other hand, it "places emphasis on freebody diagrams and actual problem solving . . . every effort being made to accomplish complete visualization of each step of the analysis and problem solving operations."

In principle this is fine, but in practice the authors seem to think that "actual problem solving" must always be carried out numerically. Not even in the sample solutions is an attempt made to suggest the well known advantages of an algebraic solution.

To quote from the author's preface: "In this text emphasis is placed on an understanding of the principles employed in the solution of problems rather than on a rote substitution in numerous formulas." Again: "While it is not feasible to require the derivation of all formulas each time used, the student should be actively discouraged from using any formula which he is him-

(*Concluded on page 26*)

THE REVIEWER

Professor Perkins received his M.E. degree at Cornell in 1915. Except for brief periods spent at the University of Wisconsin, and at the Bridgeport plant of the Remington Arms Company, he has been on the faculty of the Sibley School since 1916. He is the author of numerous technical papers and is particularly noted for his work on Graphical Torsion Analysis. Professor Perkins also wrote the mimeographed textbook formerly used by the Advanced Strength of Materials class. His affiliations include Sigma XI, the Cornell Society of Engineers, The American Society for Engineering Education, and the American Society of Mechanical Engineers.

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ECONOMY PUMPING makes sound sense to engineers who know the dollars and cents value of trouble-free pumping service. To pump longer, at lower cost, with less maintenance, rely on Economy Pumps.
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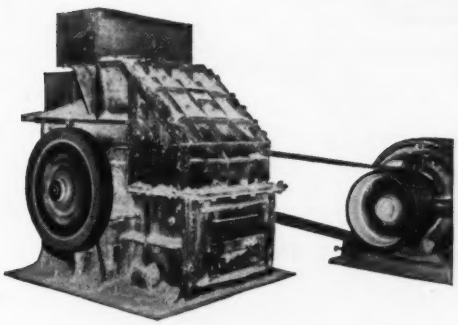
HAMILTON, OHIO

Another page for **YOUR BEARING NOTEBOOK**

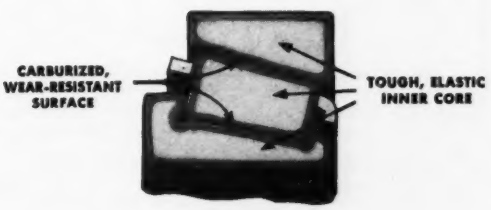


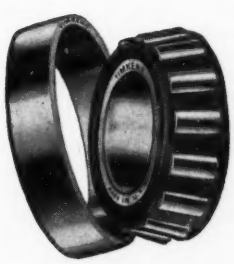
How to keep a rock crusher from minding the grind

In a hammermill rock crusher, every revolution of the rotor shaft puts a heavy shock load on its bearings. Engineers have solved this problem by using Timken® tapered roller bearings. Timken bearings take the heaviest loads—both radial and thrust. They require a minimum of maintenance and normally last the life of the crusher.

Why TIMKEN® bearings can take the tough loads

In Timken bearings, the load is carried on a *line* of contact between the rolls and races, instead of being concentrated at a single point. Made of Timken fine alloy steel, rolls and races are case-carburized to give a hard, wear-resistant surface with a tough inner core to withstand shock.





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NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◐ AND THRUST —◐— LOADS OR ANY COMBINATION ✳

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From the Following Materials:—

GRAPHITE SILICON CARBIDE FUSED ALUMINA MULLITE
MAGNESIA ZIRCON

•

LAVA CRUCIBLE COMPANY of PITTSBURGH

Pittsburgh, Pennsylvania

Book Reviews

(*Continued from page* 24)

self unable to derive." In similar vein, the foreword condemns "soft" texts of which "the distinguishing feature is . . . major emphasis on 'getting answers' by the formula route without much attempt at rigor of analysis and mastery of underlying theory." At this point it might be well to ask whether a student is likely to gain "mastery of the underlying theory" if the text does all of the derivations (for him to memorize) and never asks him to go back to the "underlying theory" and derive an occasional formula that is not in the text, or to use the underlying theory in solving a few problems which are outside the range of the formulas in the text.

As stated previously, the presentation of subject matter is excellent, but there are several topics—mostly in dynamics—which have received no consideration or have been treated in insufficient detail. For instance:

The method of virtual work is not mentioned.

The treatment of potential energy is not carried far enough to give the student a clear idea of its significance.

The discussion of moment of inertia could well have included the Mohr Circle construction.

An adequate analysis of the motions of rigid bodies presupposes a knowledge of products of inertia and principal axes of solid bodies. These are not even given passing mention. Familiarity with products of inertia and principal axes of areas is not sufficient.

It follows, of course, that the text cannot deal with unsymmetric rigid body motion such as rotation of a flywheel which has been tipped out of true by a key or by a bent shaft.

This may also explain why the consideration of dynamic balancing is limited to a mention of experimental balancing by machine—no problems.

Components of angular momentum involving products of inertia are also more or less out of bounds, leaving the student with the idea that angular momentum is always expressed as a product of moment of inertia by angular velocity.

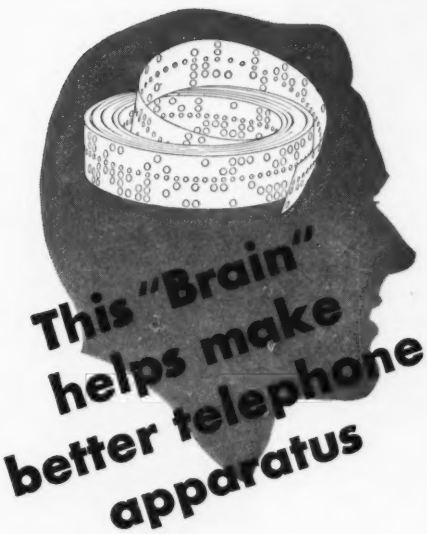
Without the use of principal axes the treatment of oblique precession is necessarily approximate.

Professor Gilkey in the foreword says that—"some may be inclined to describe this text as belonging to the Seeley and Ensign school." Whether he is justified in his implied opinion that it is superior to that text is debatable. On the one hand this text seems to have a more limited objective than the older text, but on the other hand it seems to be superior in its presentation of subject matter and in the numerical technique of its sample solutions. There are also many very good numerical problems in the new text.

Experienced teachers of mechanics will be inclined to support the claim that this text embodies the combined teaching experience of the department of Theoretical and Applied Mechanics at Iowa State College, but many of them are likely to disagree with its general philosophy and some of its procedures in the teaching of mechanics.

H. C. Perkins
Associate Professor
Mechanics of Engineering

Newsworthy Notes for Engineers



To improve the accuracy of testing Bell telephone switching equipment and to speed up tests during manufacture, Western Electric engineers designed and built a unique test set—known as the Tape-O-Matic—which has a paper tape "brain."

Controlled by a narrow paper tape, punched with coded information, the machine *automatically* performs complicated series of tests. If there is a fault in the equipment under test, the Tape-O-Matic stops, rings a bell and indicates the source of trouble on a lighted panel.

Some 1200 different tapes, varying in length from one to thirty feet, are used for testing various assemblies. Formerly an operator, in testing an average size assembly, had to make 41 individual connections. With the Tape-O-Matic, one multiple plug connection does the job. And 28 preliminary tests, 81 lamp observations and 71 key operations are replaced by one tape insertion and the push of a button.

The Tape-O-Matic can cut testing time as much as 80%—practically eliminates the possibility of human error—and helps to assure equipment of highest quality. It is a good example of the ingenuity, skill and thoroughness which Western Electric engineers put into making Bell telephone equipment.

The 1500-pound Tape-O-Matic is one of the largest, most complex and most versatile test sets that Western Electric engineers have ever devised.

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

Engineering problems are many and varied at Western Electric, where manufacturing telephone equipment for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for production of highest quality communications equipment.

AGAIN MORRIS HELPS— THIS TIME TO BUILD CLEVELAND'S AIRPORT

The 12" MORRIS Dredge "Johnnie Wells," once sunk and raised, now working on the new Cleveland Airport fill.

Originally Equipped in 1927 by Morris Machine Works for a Buffalo, N. Y., project.

Moved to Huron, Ohio, for harbor work.

Sunk in Storm enroute to Bay City, Mich., while off Pelee Island.

Raised and Salvaged by L. A. Wells Construction Co.

Back in Service on various dredging contracts after motors and electrical equipment were dried and cleaned.

And in 1949—A vital fill-in job at the new Cleveland Lake Front Airport called for exacting specifications. It was the "Johnnie Wells" that met them. This time with a new hull and new heavy duty MORRIS dredge pump driven by a 500 H.P. Diesel engine to replace the old motors.

Over 120,000 cu. yds. a Month have been moved by this 12" MORRIS Dredge.

The story of the "Johnnie Wells" proves that there's material and engineering "guts" in a Morris Portable Dredge. *For dependable, efficient service, maximum output with a minimum of power and maintenance, year in—year out economical performance—BUY MORRIS.* For details about this type and other Morris Dredges, write today for BULLETIN 177.

John C. Meyers
E.E. '44
Executive Vice-President

MORRIS MACHINE WORKS
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MORRIS *Centrifugal Pumps*

Television Programming

(*Continued from page* 15)

into two general categories, the economic and the technical. The economic problems stem mainly from the fact that there is as yet insufficient advertising to cover the high cost of program production. Advertisers are reluctant to spend huge sums to improve the quality of programs since the television audience is still comparatively small

—*Courtesy DuMont*

Complete battery of portable camera equipment, monitors, power supplies and synchronous generators used for remote telecasts.

and concentrated around a few large cities. However, plans which would enable every home across the country to enjoy this new meduim are now being put into effect. As the number of receivers increases the number of advertisers will increase and then more will be spent to create better shows.

Once the economic problems have been eliminated it will be only a matter of time before the technical problems of program production and broadcasting will be solved. Then and only then will the vast potentialities of this new medium be fully exploited, enabling everyone to share in the enjoyment which it promises.

SPRINGBOARD TO A CAREER IN ENGINEERING

by J. F. ROBERTS
Manager, Hydraulic Department
General Machinery Division
ALLIS-CHALMERS MANUFACTURING COMPANY
(Graduate Training Course 1919)

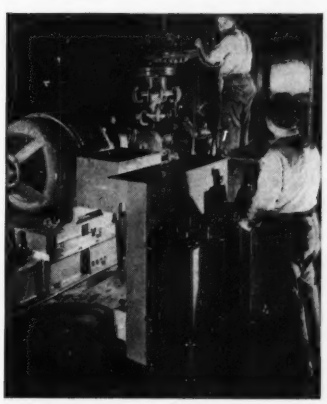
YOU HAVE to start somewhere—and as far as I know, flagpole painting is the only job where you start at the top. Next best thing is to get in where there are many opportunities, and many interesting, worthwhile paths to follow—particularly if you are not entirely sure just what type of work you want to do. You then have a chance to try more than one field, and eventually find the work that will give you the most in satisfaction and success.

J. F. ROBERTS

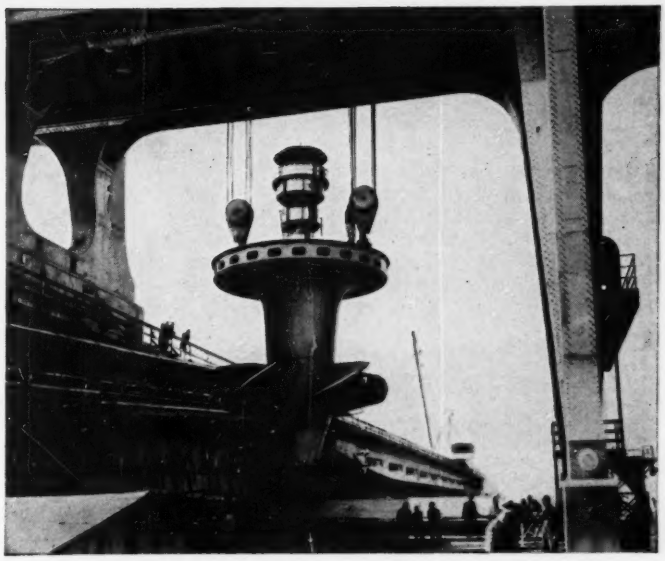
Growth of Hydraulics

The field I'm best qualified to discuss is hydraulic engineering. Crude waterwheels were man's first mechanical source of power. Today, in highly perfected modern form, they're still a major source of abundant, low-cost electric power. The field is constantly expanding and holds a world of opportunity. Hydraulic power becomes increasingly important to the nation as the need for low-cost power steadily increases. Moreover, a hydraulic plant once installed produces energy with a minimum of manpower. There's no fuel to mine, prepare, ship, unload and burn—small operating personnel is required.

Right now at Allis-Chalmers we're designing and building turbines for vast new hydro-power projects, not only for the U.S.A. and Canada, but also for Mexico, South America, Norway, New Zealand and the Philippine Islands. We're also restoring many veteran turbines to better-than-original efficiency and capacity after long years of faithful performance.



Graduate students conduct performance tests of centrifugal pump units.



Kentucky Dam TVA Field erection view of 250-ton gantry crane lowering hydraulic turbine assembly. One of five 44,000 hp, 48-ft. head, Kaplan type turbines.

Hydraulics was a field that I hadn't seriously considered as an undergraduate at the University of Wisconsin. I graduated as a Mechanical Engineer in 1918, and entered the Allis-Chalmers Graduate Training Course in January 1919. It was there that I got interested in the big waterwheels.

My first assignment was in steam turbine erection. Then I moved over on the hydraulic turbine test floor. In May 1919 I was sent to North Carolina on the acceptance tests of a big hydro-electric power installation. I continued with hydraulic field work such as tests and trouble shooting until 1925, when I went into the sales end of the work. Two years later I left the manufacturing side and became Hydraulic Engineer for the Power Corporation of Canada, supervising the design and installation of some 15 plants.

In 1936 I became Hydraulic Engineer for the U. S. Government TVA, involving 12 projects and 30 large units. I returned to Allis-Chalmers in 1942 as Manager of the Hydraulic Department—and had the unique experience of building some of the same turbines that I had purchased for TVA.

Vantage Point for All Industries

These personal notes serve to illustrate two interesting facts about the Allis-Chalmers Graduate Training Course. First, it's tailor-made for each student. Since 1904, graduate students here have been helping plan their own courses—making changes as they went along and new interests developed. They've had an opportunity to divide their time between shop and office—follow important projects through from drafting board to installation.

Second, the organization is in close contact with virtually all phases of industry: hydraulic or steam electric power plants and utilities; mining, smelting and rock products; public works; steel and metal working; textiles; food processing; flour milling. Allis-Chalmers builds basic machinery for ALL these industries and many more. Its engineers, executives, salesmen and production experts have a ringside seat for industry in action.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

School Societies

American Society of Mechanical Engineers

David Ross won the first prize of $25 in the ASME Public Speaking Contest for his speech, "The Future of Aircraft Propulsion." Second prize of $15 was won by Howard Kallen and third prize of $10 by Gene Tuttle.

Kappa Tau Chi

Philip F. Gottling has received the Kappa Tau Chi Scholastic Achievement Award, presented annually to the outstanding junior in the administrative option of the ME course on the basis of scholarship and extracurricular activities. His name has been engraved on the Kappa Tau Chi plaque in the Sibley library.

Chi Epsilon

James Bailey '52
Edward Bergun '52
Wesley Bigelow '52
Floyd Cannon '50
John Carpenter '50
Richard Chittenden '52
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Donald Gleason '50
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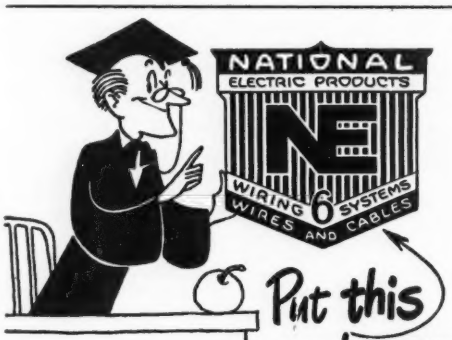
Robert E. Redfield, '51
James R. Baum, '52
Thomas B. Gill, Jr., '52
Philip F. Gottling, Jr., '52
Donald S. Griffin, '52

(*Concluded on page* 32)



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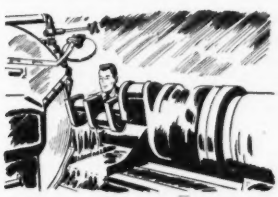
"To make traveling more fun. The idea is to give people more to see and do while riding faster and safer. That means more passengers for the railroads so that they can keep fares down and still add more comfort to long trips."



"Railroad comfort comes from many things, son. Smooth-fitting parts are important. Parts like Diesel engine crankshafts, pistons and wheels. That's why so many railroad shops use Norton grinders and Alundum grinding wheels to make parts smooth.

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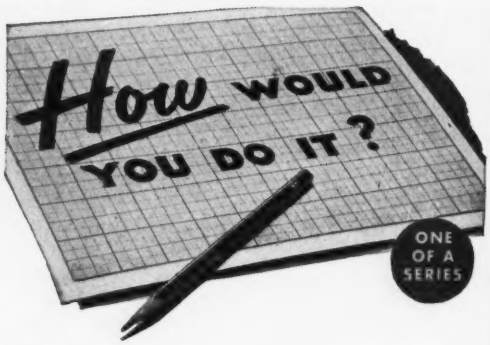

PROBLEM — You are designing a machine which includes a number of electrical accessories any one of which can be turned on by means of a rotary switch. For reasons of assembly and wiring this switch has to be centrally located inside the machine. Your problem is to provide a means of operating the switch from a convenient outside point. How would you do it?

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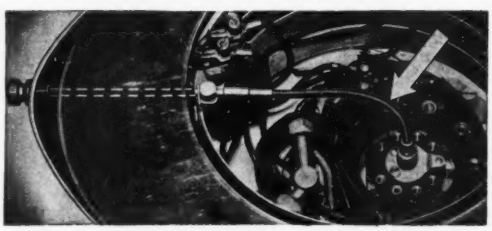

This is just one of hundreds of remote control and power drive problems to which S.S.White flexible shafts provide a simple answer. That's why every engineer should be familiar with these "Metal Muscles"* for mechanical bodies.

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School Societies

(*Continued from page* 30)

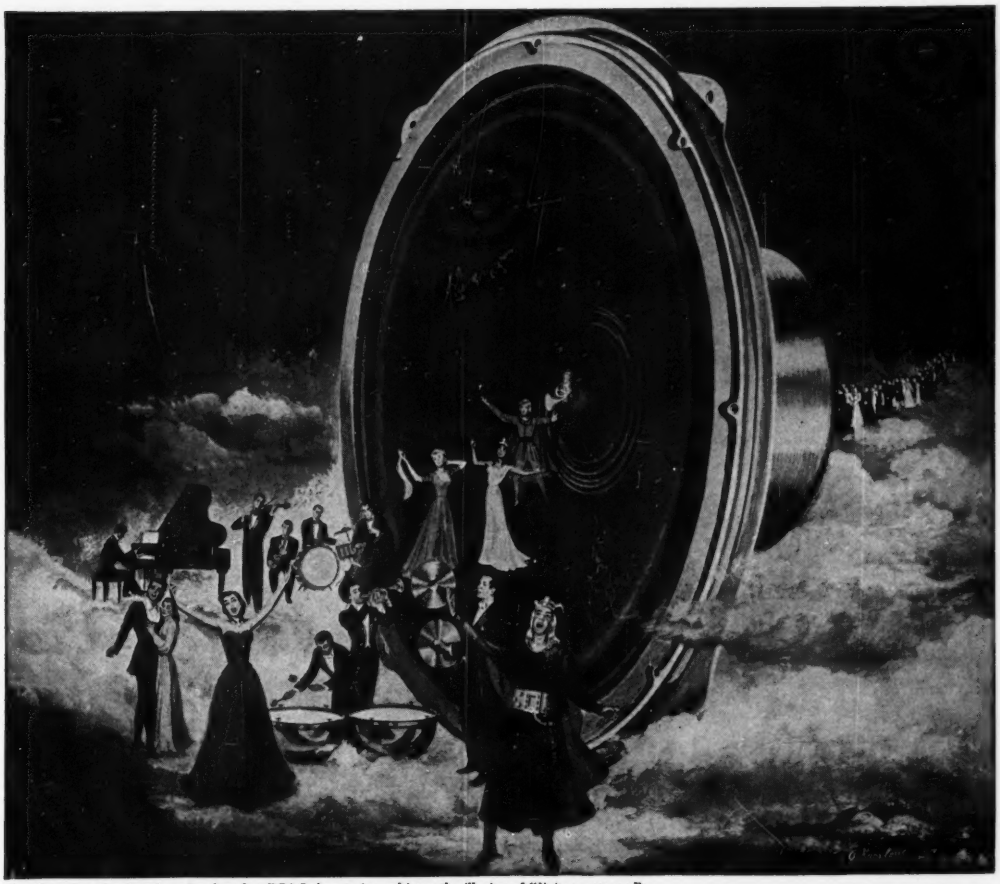
Richard D. Rippe, '52
Samuel E. Rogers, '52
Peter H. Rose, '52
Peter D. Spencer, '52

Eta Kappa Nu

Paul Auerbach '50
Herbert J. Winegar '50
Ramon H. Aires '50
Lawrence D. Hall '50
Albert J. Monahan '50
James M. Meeker '50
Laurence T. Deabler '50
John H. Sternberg '50
Raymond F. Jacque '50
Louis C. Paine '51

Honorary Initiates

Dr. Henry Booker
Prof. Walter Jones



New Duo-Cone loudspeaker, developed at RCA Laboratories, achieves the illusion of "living presence."

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For years, working toward the ultimate in sound reproduction, scientists have sought for *living presence*—the illusion that a musician or speaker is talking, singing, playing in your home.

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In addition, the RCA Duo-Cone loudspeaker's wide angle of sound pervades every corner of a room without sharply directed blast or blare. Its response to tones of every frequency is smooth, flowing, and even.

* * *

See the newest advances of radio, television, and electronics at RCA Exhibition Hall, 36 W. 49th St., New York. Admission is free. Radio Corporation of America, Radio City, N. Y.

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- Design of receiving, power, cathode ray, gas and photo tubes.

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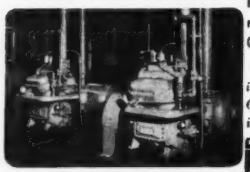
Baxter Laboratories, which have the largest production of intravenous solutions and blood transfusion equipment in the world today, use two Frick NEW "ECLIPSE" compressors for cooling the offices, research departments, and many work areas in their recently completed plant at Morton Grove, Ill. This covers 300 by 400 ft. Frick installation made by Midwest Engineering and Equipment Co., Sales Representatives in Chicago.

Assembling Expendable Transfusion Sets



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Techni-Briefs

(*Continued from page 22*)

resistance of the finished paper.

Five DuPont rubber research men disclosed the details of a practical process which has been developed for adding neoprene, a synthetic rubber, to paper in that stage of the process known to the industry as "at the beater." In most of the plant work a new type of neoprene latex was employed. The new product, known as Neoprene Latex Type 735, is a modification of standard types and was described as being well adapted to the technique used in adding it to the pulp.

A striking observation made during the experimental work was that very small percentages of the new neoprene-produced papers have outstanding wet strength. In recent years, resins of various sorts have been added to pulp to produce papers having high wet strength, but it has not been previously possible to produce high wet strength by beater addition of small percentages of elastomers. In addition to high wet strength, it was reported that the treated papers possessed unusually high breaking elongation, high tensile strength, and excellent resistance to folding and to tearing.

In addition, neoprene-treated papers display considerable resistance to a variety of chemicals. As an example, these treated papers after 24 hours in 5 percent solutions of hydrochloric, sulfuric, nitric, phosphoric, and stearic acids, retained a considerable proportion of their original strength. The results of these tests indicate the possible use of neoprene-treated paper for many packaging operations, particularly those involving industrial chemicals and possibly citrus fruits. Neoprene treatment also might make it possible to use lighter weight papers for producing tough, wear and scuff resistant packages of many kinds.

Cold-Drawn Steel

Engineers and operating supervisors of The Timken Roller Bearing Company's Gambrius (Ohio) plant report that the use of a special phosphate-coating treatment for steel tube stock to be cold-drawn (1) aids it to retain lubricant longer, (2) permits greater reduction per pass and faster drawing, and (3) results in less damage to tubing and dies.

In some instances this phosphate compound, known as "Banox," has made it possible to give steel tubing a double pass without the intermediate annealing formerly necessary, Timken engineers reported. Unlike other phosphate materials first used for this pre-drawing treatment, Banox requires no heat for application. Bundles of tubing are immersed for two minutes in an unheated 1¼ percent solution of this phosphate compound in the pickling department, before "doping" with cold-draw lubricant. Thus it is economical to use, and does not add to the fuel consumption of the plant.

Calgon chemists explain that Banox "plates out" on steel surfaces as an amorphous phosphate film, microscopically thin yet plastic and continuous, and closely following the metal surface contour. It is deposited spontaneously from an unheated solution without visible attack on the metal.

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Leading manufacturers of insulated wire and cable are making their products available now with conductors of Alcoa E.C. Aluminum. Suppliers of fittings and accessories are producing correct types for use with aluminum. If you would like further details, toward the day when you may be in a position to suggest a saving on electric wiring, write today for a copy of the illustrated book "Questions and Answers About Aluminum Conductors", ALUMINUM COMPANY OF AMERICA, 742E Gulf Bldg., Pittsburgh 19, Pa.

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Alumni News

(*Continued from page* 19)

5th Naval Construction Brigade. Following the war, he was assigned as Deputy Chief of the Bureau of Yards and Docks, with the rank of rear admiral, the youngest in the Navy at that time.

Austen W. Boyd, Chem.E. '43, a member of the Chemical Department of the General Electric Co., has received the Coffin Award, the Company's highest honor to employees, for his work on a silicone project at the Waterford plant. The project included engineering, development, design, construction, and testing of an improved reactor for the production of silicone chemicals at improved chemical efficiency coincident with lower material and labor costs. One of the youngest men ever to receive the award, he lives at 160 Seventh Ave., Troy, N. Y.

R. L. Schmidt, Chem.E '44, now heads the College Department of the Co-operative Bureau for Teachers, 1776 Broadway, New York. He lives at 194 Columbia Heights. Brooklyn, N. Y.

The CORNELL ENGINEER earnestly solicits all newsworthy items about alumni of the College of Engineering. This section of the magazine is designed to be of service in keeping Cornellians in touch and will function well only if the alumni themselves help to keep its columns interesting.

Robert L. McMurtrie, C.E. '46, is assistant supervisor of track for the Pennsylvania Railroad in Jersey City. He lives at 183 Garfield Ave., Jersey City, N. J.

L. W. Bertelsen, Chem.E. '47, is working for his L.L.B. degree at Harvard. He is co-author of an article on "Vapor-liquid Data for the System Carbon Tetrachloride—Normal Propanol," which was recently published in **Engineering Chemistry.** He is also employed by the patent firm of Kenway, Jenney, Witten, and Hildreth.

T. M. Jackson, Jr., Chem.E. '47, of 1603 E. Gawen Ave., Philadelphia, is handling technical sales in the chemical, laundry, and textile fields for the Fletcher Works, Inc. of Philadelphia. He recently married **Jean Budd, '48.**

Thomas L. Savage, M.E. '48, of 828 Elk St., Franklin, Pa., is an engineer with Joy Manufacturing Co., of Franklin.

R. E. Mersfelder, Chem.E. '48, is working on process development for Proctor and Gamble in Cincinnati, O. He expects a temporary transfer to Long Beach, Calif., to help in setting up the Company's new Long Beach plant. He recently married **Sylvia Jackson, '49.**

S. L. Parson, Chem.E. '48, is doing research and development work for the International Shoe Co. of East St. Louis. He resides at 142 N. 74th St., East St. Louis, Ill.

A. T. Guzzo, Chem.E. '48, is engaged in research on solid propellants for rockets for the Thiokol Corp. of Hoopeston, Ill. He lives at 602 S. Fifth St., Hoopeston.

W. P. Barber, Chem.E. '49, of 266 Glendora Ave., Long Beach, Calif., is with the Union Oil Co. of California in their technical training program. He is co-author of a recent article on Solubility Data for the Aniline-Nitrobenzene Water System, and was recently married to **Virginia Wylie, '49.**

Carl P. Irwin, C.E. '49, lives at 2315 South Delaware, Tulsa, Okla. He is in pneumatic tools sales work for Ingersoll Rand Co.

R. L. Fairchild, Chem.E. '49, of 578 Castleton Ave., Staten Island, is a foreman in the continuous hydrolyzing and soap-making department of Proctor and Gamble Co., Port Ivory, Staten Island, N. Y.

C. W. Shonnard, Chem.E. '49, is working on research and development at the Colgate-Palmolive-Peet Co. in Jersey City and is studying structural engineering in his spare time. His address is 128 Madison Ave., Wortendyke, N. J.

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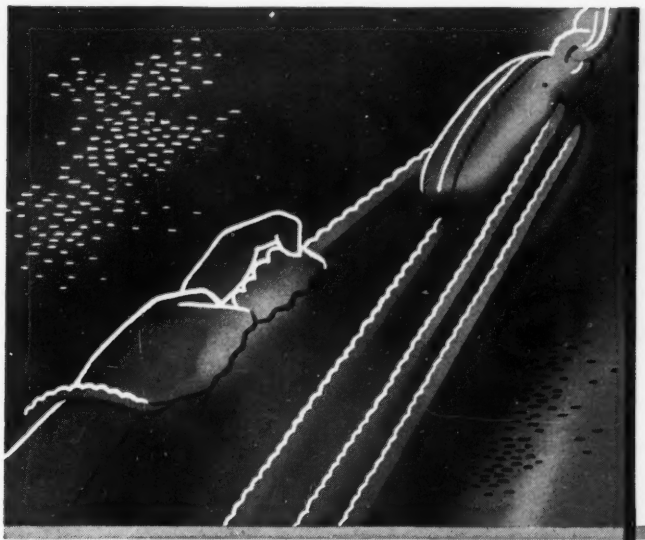

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Prominent Faculty

(*Continued from page 17*)

gineering at the Institute of Technology in Bandoeng, Java and at the same time was an adviser to government and contracting firms. It was during these years that Professor Bijlaard did most of the research that was to establish him as a leading authority on structural engineering.

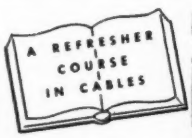
Most of his achievements have had to do with the plasticity and buckling of steel plates and shells, including his developments in bridge, dock, and pier construction. For his advisory services he was Knighted in the Order of the Netherlands Lion. To date he has published about seventy papers on erection methods of steel bridges, economy of structures, computation of plates in reinforced concrete, and stability of bars and frames. One of the more interesting facts he has revealed is that the plastic behavior of the earth's crust is in many ways analogous to that of steel plates.

In 1937 Professor Bijlaard left Java, after having served as Dean of the Institute of Technology for one year, and returned to Delft, Holland, where he served as a professor in steel structures. However, he again returned to Bandoeng in 1938 where he remained until the outbreak of the war. Unfortunately he was captured by the Japanese and interned in a concentration camp until September, 1945.

Upon his release he resumed his work at the Institute, only to leave it in 1946 to serve as professor of applied mechanics in Delft, Holland, and as a technical adviser of the International Association of Bridge and Structural Engineering in Zurich, Switzerland. Desiring to see his daughter, who now attends Cornell, he came here in February, 1949, and decided to stay.

In addition to the tremendous amount of research he has done, Professor Bijlaard has also found time for numerous societies and "extra-curricular" activities.

At Cornell he works for the Column Research Council and the N.A.C.A., and is a consultant of the Cornell Aeronautical Laboratory in Buffalo. Furthermore, he is a reviewer for *Applied Mechanics Reviews* and also serves as a technical adviser to the International Association of Bridge and Structural Engineering. To complete the list, he belongs to the A.S.C.E. and the Royal Institute of Engineers.



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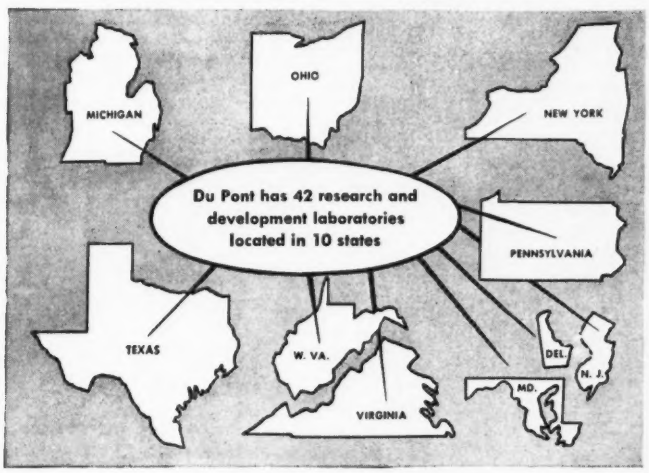


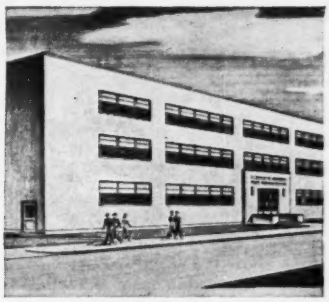
THE DU PONT COMPANY is a large company. Its many manufacturing plants are now located from Maine to California. Likewise, the Company's research activities are spread over a wide area. From the Founder's informal scientific experiments on the Brandywine have sprung 42 research and development laboratories in ten states.

Each manufacturing department* has its own research director and maintains facilities for studies in its specialized fields. Thus, research having to do with dyes, neoprene and fine chemicals is centered at Deepwater, N. J.; research on cellophane and other transparent wrapping films at Buffalo, N. Y.; research on viscose rayon at Richmond, Va.; and research on coated and impregnated fabrics at Newburgh, N. Y. These are only a few of the places where Du Pont scientists are now at work. Each manufacturing department does fundamental research as well as applied research on new processes and products.

Many types of training

At any one time, many hundreds of different projects are under way in these laboratories. Though a relatively large number of Du Pont technical people are chemists and chemical engineers, other fields of training are strongly represented.

Among the scientists working with Du Pont are mechanical, electrical, civil, industrial, mining, petroleum, textile, architectural and safety engineers, physicists, metallurgists, biologists and mathematicians. About 30% of these men and women who



Artist's drawing of the Marshall Laboratory, new Du Pont laboratory for research on finishes. Under construction at Philadelphia, it should be ready for occupancy by late 1950.

are engaged in technical activities at Du Pont hold doctor's degrees.

Interchange of thinking

All manufacturing departments may draw on the services of the chemical, engineering and toxicological laboratories of the company in Wilmington. In addition, the Chemical Department's library at the Wilmington Experimental Station circulates reference material, conducts literature and patent searches and issues a weekly abstract of pertinent articles found in the important chemical journals of the world. This supplements normal work of this kind done by the various manufacturing departments.

No matter where a Du Pont research man may work, he has every opportunity to use his best talents, to advance as his abilities develop, and to profit by interchange of thinking with scientists whose minds complement his own.

*There are ten Du Pont manufacturing departments—each conducting research: Electrochemicals; Explosives; Fabrics & Finishes; Film; Grasselli Chemicals; Organic Chemicals; Photo Products; Pigments; Polychemicals; Rayon.

★ ★ ★

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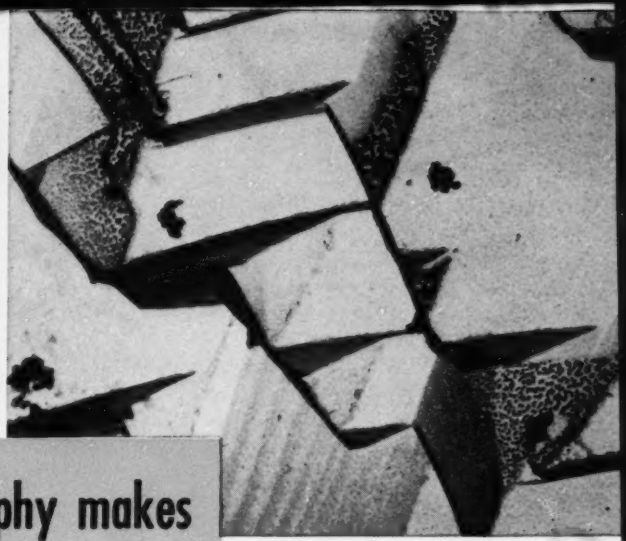

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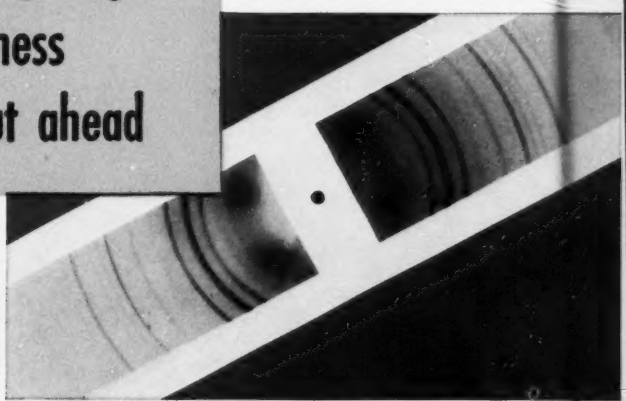

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On Bigness

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• • •

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